PY2021 Interim Framework Home Assistance Program Evaluation Report

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SUBMITTED TO:
Independent Electricity System Operator

SUBMITTED BY:
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NMR Group, Inc.

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Acknolwedgements

The NMR team would like to thank the hundreds of participants that supported the NMR team's surveys. Their cooperation with the NMR team's efforts has produced high quality data that will serve Ontario conservation efforts for years to come.

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Acronyms

Acronym	Definition
AC	Air Conditioner
AFT	Affordability Fund Trust
AV	Audiovisual
CDM	Conservation and Demand Management
CE tool	Cost-Effectiveness Tool
CEF	Combined Energy Factor
CF	Correction Factor
CFF	Conservation First Framework
CI	Confidence Interval
DHW	Domestic Hot Water
DSM	Demand Side Management
EM&V	Evaluation Measurement and Verification
ES QPL	ENERGY STAR Qualified Product List
EUL	Effective Useful Life
FAST	Field Audit Support Tool
FTE	Full-time equivalent
HAP	Home Assistance Program
HOU	Hours of Use
IDI	In-depth Interview
IESO	Independent Electricity System Operator
IF	Interim Framework
IO	Input-Output
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hours
LDC	Local Distribution Company
LEAP	Low-Income Energy Assistance Program
LED	Light-emitting Diode
LPM	Liters Per Minute
LUEC	Levelized Unit Electricity Costs
MAL	Measures and Assumptions List
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
OESP	Ontario Electricity Support Program
PAC	Program Administrator Cost Test
PIA	Prescriptive Input Assumption
PPS	Probability Proportional to Size
PY	Program Year
RR	Realization Rate

Acronym	Definition
StatCan	Statistics Canada
SUPC	Supply and Use Product Classification
SUT	Supply and Use Table
TRC	Total Resource Cost Test
TRM	Technical Reference Manual

Executive Summary

NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc., (collectively, "the NMR team") and under contract to the Independent Electricity System Operator (IESO), performed an evaluation of the Home Assistance Program (HAP) for Program Year 2021 (PY2021) as part of the Interim Framework (IF).

Program Description

HAP is a centrally delivered program administered by the IESO. The program provided eligible low-income residential customers and eligible non-profit housing providers with the opportunity to receive energy-efficient solutions that aim to help reduce energy consumption and costs while also improving the home's comfort, look, and feel. Income-qualified homeowners and tenants in both non-profit and private rental housing are eligible, as are building owners and managers of non-profit housing. The program offers free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants. Measures installed during the home audit or as part of a follow-up visit may include ENERGY STAR® light-emitting diodes (LEDs), smart power strips, thermostats, high-efficiency showerheads, aerators, drying racks, energy-efficient refrigerators, window air conditioners, attic/basement insulation, and weather-stripping around doors and windows.

Evaluation Objectives

The HAP evaluation sought to address several research objectives in PY2021, including the following:

- Verify energy and demand savings;
- Estimate realization rates (RRs). HAP has a deemed value of 1 for Net-to-Gross (NTG) ratio since it is a low-income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions;
- Perform a limited process evaluation; and
- Analyze job impacts for the program.

Summary of Results

The impact evaluation results for HAP are displayed in Table 1. The overall RR for PY2021 is 107% for energy savings and 120% for demand savings. The overall program results are compared to previous program years in Section 3.3.

Table 1: HAP PY2021 Results

Metric	Units	Evaluated
Participation	Projects	2,234
Participation	Homes	2,234
Reported Energy Savings	MWh	2,843
Reported Demand Savings	MW	0.19
Gross Energy RR	MWh	1.07
Gross Demand RR	MW	1.20
Gross Verified Energy Savings	MWh	3,047
Gross Verified Demand Savings	MW	0.23
Net-to-Gross (NTG) Ratio	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	3,047
Net Verified Annual Demand Savings (First Year)	MW	0.23
Net Verified Persisting Energy Savings to PY2022	MWh	3,047
Net Verified Persisting Demand Savings to PY2022	MW	0.23
Total Resource Cost (TRC) Test Ratio	--	0.40
Program Administrator Cost (PAC) Test Ratio	--	0.33
Levelized Delivery Cost (Energy)	$/kWh	0.15
Levelized Delivery Cost (Demand)	$/kW	1,994

KEY FINDINGS AND RECOMMENDATIONS

This section summarizes the PY2021 evaluation key findings and recommendations. Section 7 presents these key findings and recommendations in greater detail.

Finding 1: **HAP saw the lowest number of participants and the smallest amount of net verified savings but had the largest savings on a per-project basis when compared to previous program years.** In 2021, HAP completed 2,234 projects in 2,234 homes. The program achieved first year net verified energy savings of 3,047 (MWh) and 0.23 MW of first year net verified demand savings. Verified energy savings on a per-project basis increased in PY2021 by 33% from PY2020 and 58% from PY2019 levels (866 kWh in PY2019, 1,028 kWh in PY2020, and 1,364 kWh in PY2021) despite shrinking baselines, such as those associated with lighting end-uses which have historically contributed to the majority of HAP savings.

- **Recommendation 1.** Continue to promote and deliver deeper savings measures (e.g., weatherization, appliances, and smart power bars) to income-eligible participants, especially in historically underserved areas. Future iterations of this program could monitor both geographic reach and the extent to which measures with greater savings are delivered to underserved areas and how they are contributing to savings goals. The program could refine and expand geo-targeting efforts informed by the previous effort. This may help encourage targeted marketing and outreach campaigns that build community trust in IESO programs and result in increased participation in key areas. In addition, improvements in tracking data (refer to Recommendations 2a and 2b) can be used to determine whether certain geographic areas have higher concentrations of electric heating and water heating equipment.

Finding 2: HAP program tracking data includes a mixture of completed and incomplete projects including both installed measures and measures waiting to be installed, along with unique identifiers for each. However, the tracking data does not typically include key characteristics collected during audits such as building or equipment type. This information could be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms used during in-home audits. However, only in some cases is this information captured in the program tracking data. The tracking data included variables to identify unique projects and measures, and separate variables to determine the level of completion a project had obtained. These unique identifying variables are critical for impact accounting over multiple years in a framework. However, since the tracking data was not limited to completed projects, the IESO and NMR evaluation teams were required to piece together which measures and projects were completed during PY2021. The remaining projects and measures that were incomplete at the time of the PY2021 evaluation will be included in the PY2022 evaluation.

- **Recommendation 2a.** In future versions of this program, continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

- **Recommendation 2b.** Work with program staff and implementation contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data collected on-site (e.g., efficiency, capacity). This could include revising the IESO's Field Audit Support Tool (FAST) program or supporting the development of a new uniform electronic data collection form for auditors to fill out on-site, which can then be uploaded directly into the tracking data.

Finding 3: In PY2021, there were 220 weatherization projects completed and savings deepened on a per-project basis compared to PY2020. Gross verified savings for weatherization measures were higher on a per-unit basis in PY2021 compared to PY2020 and PY2019 (1,939 kWh in PY2019, 2,400 kWh in PY2020, and 2,458 kWh in PY2021). This is in part due to increased savings associated with weatherization measures on a per-project basis (4,333 kWh in PY2021 compared to 3,669 kWh in PY2020 and 3,240 kWh in PY2019). The total savings from weatherization measures decreased by 7% from PY2020, but the proportion of program savings attributed to weatherization measures increased in 2021 (from 9% to 31%).

- **Recommendation 3.** The program could consider pushing shell insulation, especially attic insulation, to increased levels of efficiency to further deepen savings and increase occupant comfort and health benefits. Furthermore, weatherization measures yield measure-level total resource cost (TRC) ratios higher than the total program's TRC ratio, so increasing weatherization measure implementation would likely lead to higher program-level cost effectiveness.

Finding 4: Participants, auditors, contractors, and delivery vendor staff recommended offering additional equipment through the program. Over one-half (54%) of surveyed

participants provided recommendations for additional energy-efficiency equipment or services for inclusion in HAP. These participants most often recommended weatherization measures (53% of respondents) including windows and doors. Over three-fourths (77%) of auditors and contractors recommended additional equipment or services, including heat pumps (29%), kitchen equipment such as dishwashers and stoves (29%), washers and dryers (21%), insulation and air sealing (17%), and heating equipment (13%). Delivery vendor staff also recommended that the program consider the feasibility of offering heat pumps and generally revisit eligible measure offerings more frequently.

- **Recommendation 4a.** Consider offering additional types of equipment, such as kitchen equipment, washers and dryers, windows, doors, additional insulation and air sealing, heating and cooling equipment (such as heat pumps), and water heating equipment. Additional weatherization measures would likely increase program-level cost effectiveness, space heating and cooling measures would likely have a neutral or negative effect on program-level cost effectiveness, and kitchen appliances would likely decrease program-level cost effectiveness.
- **Recommendation 4b.** Revisit eligible measure offerings more frequently.

Finding 5. Participants recommended ensuring that auditors and contractors are properly trained. Close to one-fifth of participant (17%) offered recommendations for improving the program. Of those, close to one-fifth (19%) based their recommendations on a negative experience with an auditor or contractor, the most common of which was a rushed or incomplete audit.

- **Recommendation 5.** Reinforce audit protocols in training materials and communications with auditors. Consider providing a one-page visual or checklist of audit steps.

Finding 6: Project costs remained generally well below the program cap, but increased weatherization measures have pushed project cost upwards in PY2021. Approximately two-thirds of projects in PY2019 and PY2020 had an incentive of less than $1,000, compared to 44% of projects in PY2021. Similarly, approximately 90% of projects in PY2019 and PY2020 had an incentive of less than $2,000, compared to 80% of projects in PY2021.These higher project costs are due to the increased quantity of weatherization measures in 2021. This trend is encouraging, since as indicated in this and previous HAP evaluations, weatherization measures offer deeper savings along with added comfort benefits to customers. However, project costs are still well below the program cap. Since the program provides all eligible measures that each participant will accept, this finding suggests that there may be additional savings opportunities for measures not currently offered by the program.

Recommendation 6. Continue to drive deeper savings with weatherization measures. Consider expanding the measures offered by the program, as this may provide deeper savings per home. Recommendations 1, 3 and 4 provide insight on new measures or services to consider adding to the program.

Section 1 Introduction

The Independent Electricity System Operator (IESO) retained NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc., (collectively, "the NMR team") to conduct an evaluation of its Low Income, First Nations, and Residential Local programs and pilots offered under the Interim Framework (IF). This report includes results, findings, and recommendations for the Program Year 2021 (PY2021) evaluation and is specific to the Home Assistance Program (HAP).

1.1 Program Description

HAP provides eligible low-income residential customers and eligible non-profit housing providers with the opportunity to receive energy-efficient solutions that aim to help reduce energy consumption and costs while also improving the home's comfort, look, and feel. Income-qualified homeowners and tenants in both non-profit and private rental housing are eligible, as are building owners and managers of non-profit housing. The program offers free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants.

1.1.1 Delivery

Under the IF, HAP is a centrally managed program that is designed and administered by the IESO. A program delivery vendor under contract with the IESO is responsible for managing the program's delivery, including marketing and outreach, managing and training an energy auditor and installation contractor network that performs in-home energy audits and installations of program-eligible equipment, and other daily program management activities. During the energy audits, the program participants receive educational materials and tips on saving energy, as well as any necessary training about the upgrades installed.

1.1.2 Eligibility

To be eligible to participate in the program, the participant must (1) be a resident of an eligible non-profit housing property or (2) be an individual who owns, rents, or leases their residence; is listed as the primary or secondary utility account holder; and meets one of the following criteria:

- Has an annual household income for the previous year that does not exceed the program eligibility limit;
- Received assistance from an eligible assistance program in the past 12 months;
- Received a Low-Income Energy Assistance Program (LEAP) grant or was part of the Ontario Electricity Support Program (OESP) in the past 12 months; and
- Qualified to participate in a natural gas low-income Demand Side Management (DSM) program during the past 12 months.

1.1.3 Measures

The measures offered by HAP are classified into one of three tracks based on the type of measures in the project. The basic track encompasses measures that are easily installed on site by the HAP auditor. However, basic measures that conserve water usage and insulate water heater piping and storage tanks are only provided to customers with electric water heaters. The extended track includes measures that require additional follow-up actions, such as confirmation of appliance delivery, and are not completed in the duration of the initial audit. The weatherization track indicates that some form of weatherization to the building shell has occurred; this track is only available for homes that are electrically heated. The program may also improve the health and safety of the home through the installation of measures such as insulation.

1.2 Evaluation Objectives

The evaluation sought to address several research objectives in PY2021, including the following:

- Verify energy and demand savings with a 90% level of confidence at 10% precision for the program;
- Estimate realization rates (RRs). HAP has a deemed value of 1 for Net-to-Gross (NTG) ratio since it is a low-income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions from electricity savings using the IESO Cost Effectiveness Tool;
- Conduct a limited process evaluation by addressing key research questions of interest to the program; and
- Conduct a jobs impact analysis to estimate the number of direct and indirect jobs attributable to the program.

Section 2 Methodology

This section presents a summary of the impact evaluation, cost-effectiveness evaluation, the process evaluation, and the jobs impact analysis methodologies. Detailed descriptions of these methodologies are provided in Appendix A.

2.1 Impact Evaluation Methodology

To complete the PY2021 impact evaluation, the NMR team performed various evaluation activities, including a review of the program tracking data, an analysis of in-service rates (ISRs) and hours of use (HOU) using data from participant surveys, and engineering desk reviews for 227 projects. The NMR team also incorporated results from the PY2019 review of technical reference manuals (TRMs) from other jurisdictions[1] to calculate RRs.[2] These practices are a standard way to compare evaluated savings with reported savings.

Detailed descriptions of the impact methodology including the sampling plan, impact evaluation activities, gross savings calculations, and net savings calculations are provided in Appendix A.1.

An additional component of the PY2021 evaluation included accounting for projects that were completed in PY2019 and PY2020 but had not been finalized before the PY2020 evaluation occurred. These are considered true-up projects. The methods and results for the PY2019 and PY2020 true up projects are reported in Appendix A.1.6 and Appendix B.2.

2.2 Cost-Effectiveness Evaluation

The NMR team completed the cost-effectiveness analysis in accordance with the IESO requirements as set forth in the IESO *Cost Effectiveness Guide for Energy Efficiency*[3] and using IESO's *Cost Effectiveness Tool*. The energy and demand savings results from the impact evaluation were inputs into the IESO *Cost Effectiveness Tool*, as was administrative cost and incentive information supplied from IESO. A more detailed description of the cost-effectiveness methodology is provided in Appendix A.2.

2.3 Process Evaluation Methodology

The process evaluation focused on program design and delivery. The NMR team evaluated program processes through interviews and surveys with relevant program actors, including the IESO program staff, program delivery vendor staff, auditors, contractors, and participants. For

[1] See "Secondary Data Review of TRMs" (Section 2.1.2) in Methodology section of PY2019 HAP Evaluation. Appendix A of the same report contains additional details on adjusted measure-level inputs and savings parameters.
[2] Note that PY2019 adjustments also included measure-level updates to effective useful life (EUL) and incremental costs, which are presented in the Appendix B.3 of the PY2019 HAP evaluation report. The PY2021 evaluation applied the updated EULs and incremental costs that resulted from the PY2019 evaluation.
[3] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20, 2021, https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

each respondent type, the NMR team developed a customized interview guide or survey instrument to ensure responses produced comparable data and to allow the NMR team to draw meaningful conclusions. For each respondent type, Table 2 shows the survey methodology, the total population that the NMR team invited to participate in the survey or interviews, the total number of completed surveys, and the sampling error at the 90% confidence interval (CI). A detailed description of the process evaluation methodology is provided in Appendix A.3.

Table 2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
HAP IESO Program Staff and Program Delivery Vendor Staff[4]	Phone In-depth Interviews (IDIs)	2	2	0%
HAP Auditors and Contractors[5]	Web	31	71	11.3%
HAP Participants	Web	319	1,246	4.0%

2.4 JOBS IMPACT ANALYSIS METHODOLOGY

The NMR team quantified the number of full time equivalent (FTE) net job impacts as well as total net job impacts (both direct and indirect jobs) resulting from the investment and activities of each program. We relied on primary and secondary data collection and Statistics Canada[6] (StatCan) Input-Output (IO) modeling to quantify net jobs impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. When an energy-efficiency program such as HAP is funded and implemented it creates a set of "shocks" to the economy, such as demand for specific products and services, and additional household expenditures from energy bill savings. The shocks propagate throughout the economy and their impacts can be measured in terms of variables such as economic output and employment. A detailed description of the job impact analysis methodology is provided in Appendix A.4.

[4] Please note that the interviewed IESO program staff and program delivery vendor staff provided feedback for both HAP and the Energy Affordability Program (EAP). EAP was offered for the first time in PY2021 and will replace HAP in future program years. Given the similarities between HAP and EAP, there is overlap across the IESO program staff and program delivery vendor staff results in PY2021.
[5] Please note that, like the IESO program staff and delivery vendor staff interviews, the surveyed auditors and contractors provided feedback for both HAP and EAP. Given the similarities between HAP and EAP, there is overlap across the auditor and contractor survey results in PY2021.
[6] Statistics Canada is the Canadian government agency commissioned with producing statistics to help better understand Canada, its population, resources, economy, society, and culture.

Section 3 Impact Evaluation

This section presents the impact evaluation results. Details regarding the impact methodology can be found in Section 2.1 and Appendix A.1.

Measure level impacts for both energy and demand savings and true-up projects are detailed in Appendix B. Additional impact-related results, including results for the interim framework and a comparison to previous frameworks, can be found in Section 3.3.

3.1 High-Level Results

The gross verified savings for HAP have a NTG ratio of 1.0 applied to them, meaning gross verified and net verified savings are equal (Appendix A.1.5). The results presented in this section refer to the gross verified savings and can be considered equivalent to net verified first year savings.

3.1.1 Gross Verified Energy Savings Key Results

- The overall program RR is 107% for energy savings in PY2021. Savings were split among several measure categories, and this diversification of measures has improved the overall RR for the program.
- For the first time during the Interim Framework, savings from lighting measures did not dominate the program. Historically, lighting has accounted for over one half of total program savings (67% in PY2019 and 54% in PY2020).
- Weatherization measures achieved an RR of 118% and accounted for the largest portion of program savings at 31%, a sizeable increase over PY2020 (9% of HAP savings). However, energy savings decreased in PY2021 by 7% compared to PY2020.
- Lighting measures achieved an RR of 79%[7]; these measures accounted for about one-fourth (24%) of HAP savings in PY2021, down from 54% in PY2020.
- Hot water pipe insulation measures had a low RR (14%); however, these measures accounted for less than 1% of gross verified savings.
- Indoor clothes drying racks had an RR of 87% and represented 2.4% of total gross verified savings for the program.
- Smart power bars had extremely high RRs (5,983%) due to the use of a reported savings value associated with power bar timers, a measure no longer delivered by HAP. This discrepancy was also observed in the PY2019 and PY2020 evaluation.
- The appliance end-use category had an RR of 137% and attributed 11.5% to total program savings.

[7] The RR for lighting was driven by the PY2019 substantiation sheet updates which lowered baseline wattage and HOU values, as well as an ISR value of 97%.

3.1.2 Gross Verified Demand Savings Key Results

- The overall program RR is 120% for demand savings in PY2021.
- Lighting measures had an RR of 82% for demand savings; however, these measures represented about 22% of total program demand savings.
- Indoor clothes drying racks achieved an RR of 87% and achieved over 21% of total demand savings for HAP in PY2021.
- Indoor clothes drying racks accounted for the largest proportion of demand savings (21%), followed by 11W Light-emitting Diode (LED) A-line light bulbs (16%) and dehumidifiers (14.2 – 21.2 L/day) (8%).
- Appliances had a 135% RR and accounted for nearly 27% of program savings.
- Weatherization projects had higher RRs (429%) due to application of different peak demand factors or demand savings assumptions.
- All smart power bars had no demand savings reported in the tracking data (a total of 1,032 smart power bars). A measure-level RR could not be calculated for smart power bars.

3.1.3 Program Level Savings

Table 3 presents reported, gross verified, and net first year energy and demand savings for HAP in PY2021. The program gross verified RR is 107% for energy savings and 120% for demand savings. As described above, the NTG ratio is assumed 1.0 for HAP. Measure level impacts for both energy and demand savings are detailed in the subsections below.

Table 3: Program Level Reported, Gross Verified, and Net First Year Savings

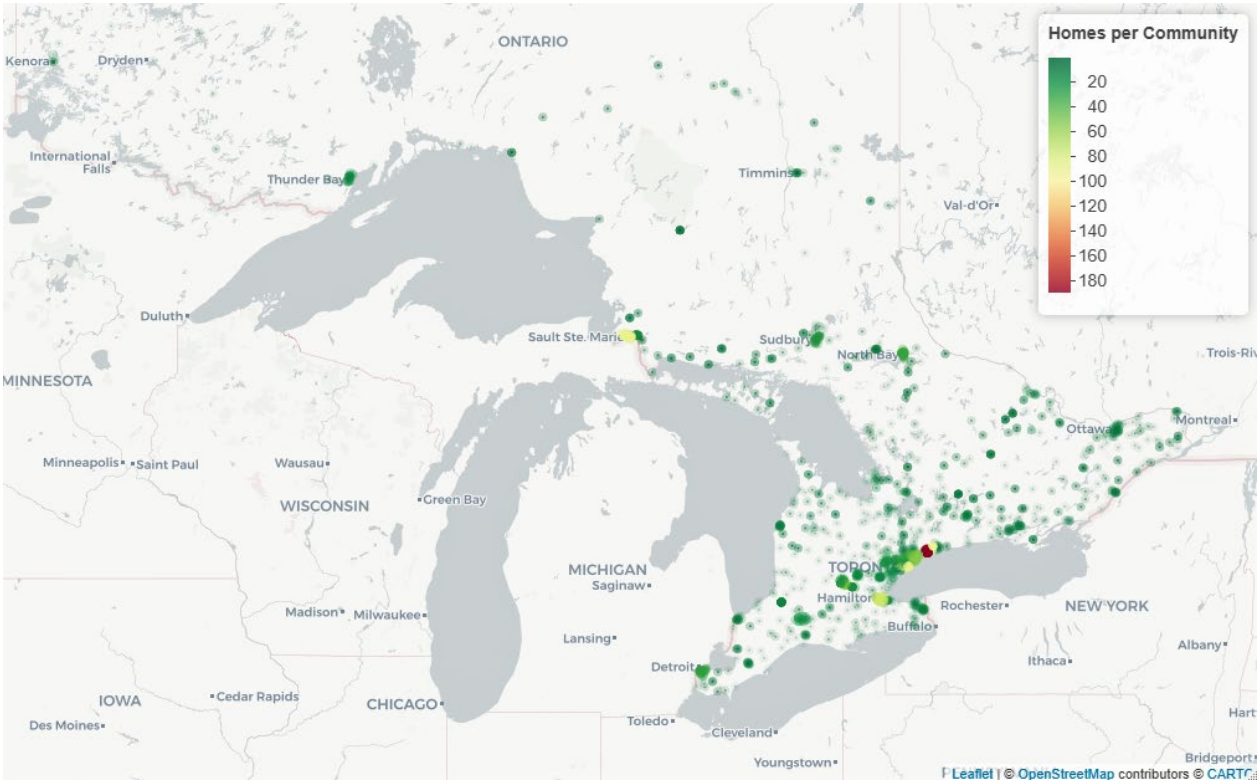
Metric	Units	Evaluated
Reported Energy Savings	MWh	2,843
Reported Demand Savings	MW	0.19
Gross Energy RR	MWh	1.07
Gross Demand RR	MW	1.20
Gross Verified Energy Savings	MWh	3,047
Gross Verified Demand Savings	MW	0.23
Net-to-Gross (NTG) Ratio	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	3,047
Net Verified Annual Demand Savings (First Year)	MW	0.23
Net Verified Persisting Energy Savings to PY2022	MWh	3,047
Net Verified Persisting Demand Savings to PY2022	MW	0.23

Figure 1 shows the geographic distribution of evaluated PY2021 HAP project homes across Ontario.[8] Green dots represent buildings where there are few other HAP participant projects within the same community, while red dots represent higher densities of participant homes. The

[8] There were 2,234 unique building addresses for the 2,234 projects. This value represents the physical addresses in the tracking data and is referred to as the HAP participant program home count.

Greater Toronto and Hamilton Area was a hot spot for PY2021 HAP participation, indicated by the high concentration of red and orange dots in the map below. Ajax, Whitby, Sault Ste. Marie, Toronto, and Hamilton are the top five communities by building count, in descending order. For the participant projects within these four communities, 41% are single-family and 59% are multifamily properties. Between these communities, Whitby has the largest share of multifamily participant projects (94%), followed by Ajax (84%), and Toronto (59%). Hamilton and Sault Ste. Marie had 25% and 1% of multifamily participant projects, respectively, though this may be an artifact of missing building type data.

Figure 1: PY2021 HAP Participant Home Distribution across Ontario



3.2 Gross Verified and Reported Savings Assessment

Weatherization measures have surpassed lighting as the largest contributor to savings at 31.3% of total program verified savings of 3,047 MWh, an increase from 8.7% in PY2020 (Figure 2). The proportion of lighting savings (24.2% of program) compared to overall program savings is less than the PY2020 HAP evaluation, which was 54% of total program gross verified savings.[9] Miscellaneous measures, appliances, and smart power bars were the next largest end-use categories for PY2021. Domestic hot water measures only made up 1.8% of program savings.

[9] http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2017/2017-Home-Assistance-Program-Evaluation-Report.pdf?la=en

Figure 2: PY2021 HAP Gross Verified Energy Savings by End-Use (kWh/year)

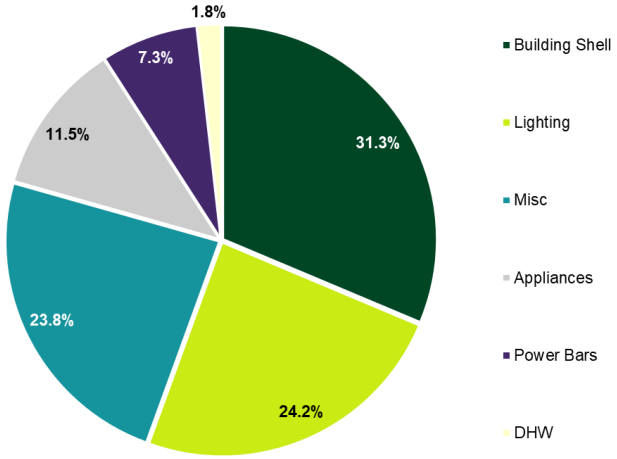
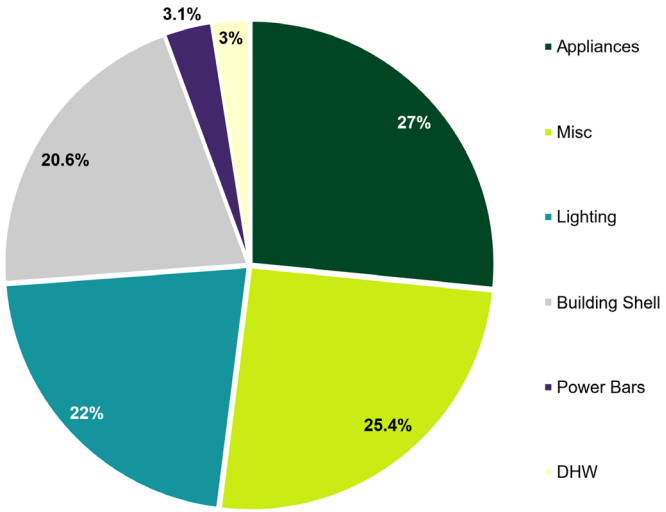


Figure 3 displays the proportion of gross verified demand savings by end-use category for HAP. The gross verified demand savings were primarily attributed to appliances, although indoor clothes drying racks were the measure that contributed the most to demand savings (21.4% of program). Weatherization measures covered another 20.6% of gross verified demand savings for HAP.

Figure 3: PY2021 HAP Gross Verified Demand Savings by End-Use (kW/year)



3.3 COMPARISON OF IMPACT RESULTS WITH PREVIOUS EVALUATION YEARS

Table 4 presents the results of HAP activities over the past several years.[10] The program participation ramped up in PY2019 and PY2020, but that has not always resulted in more verified energy savings on an annual basis. PY2021 saw the lowest amount of participation and the smallest net first year savings since PY2016.

The primary reason for the decay of savings over time is adjustments for lighting measures and adjustments to other measures delivered by HAP that often result in reduced energy and demand savings due to increased baselines that reduce the savings associated with the installed efficiency measure. However, the amount of verified energy savings attributed to weatherization projects increased by nearly 800 MWh in PY2020 compared to PY2019, with more projects with weatherization completed in PY2021. The increased focus on weatherization projects continued in PY2021, with 220 projects completed and over 953 MWh of savings. Though the savings represent a 7% decrease compared to PY2020, the proportion of savings attributed to weatherization projects in PY2021 was higher than in previous years. Weatherization projects have a longer EUL than other measures in HAP and can drive lifetime savings higher for a project. In addition, HAP transitioned from delivering power bar with timers to smart power bars, which contributed to increased savings on a per project basis.

Additional factors that impacted net verified first year savings include updated gross verified per-unit savings (based on the PY2019 substantiation sheet updates), the correction of smart power bar savings (using historic power bar with timer savings values), and ISR and HOU updates.

The program participation values in are reflective of the number of unique Application IDs (also known as projects) identified in the program's tracking data. A participant may receive more than one Application ID if a second site visit is required to the same household.

It should be noted that includes results from two different frameworks: the Conservation First Framework (CFF) which covers the PY2016-PY2018 time period and the Interim Framework (IF) which covers PY2019-PY2021 time period. There are additional true-up projects from the CFF that were evaluated in 2020 and 2021 but are not included with the results associated with the IF columns in the table. It also is worth noting that true up projects for HAP will also occur in PY2022, so the results presented below should not be considered the final Interim Framework results for HAP.[11]

[10] The program administered a limited impact evaluation in PY2018.
[11] The NMR evaluation team will conduct a true-up process to account for any remaining unevaluated measures that have been installed through HAP during the PY2022 evaluation cycle. This update will summarize the impacts for all evaluated and trued up HAP projects completed during the IF.

Table 4: Comparison of Program Performance over Time

Framework	CFF	CFF	CFF	CFF	CFF	IF	IF	IF
Program Metric	PY2016	PY2017	PY2018[a]	PY2019[b]	PY2020[b]	PY2019[b]	PY2020[b]	PY2021
Program Participation (Projects)	5,066	6,910	4,609	8,739	334	9,988	11,440	2,234
Program Reported Energy Savings (MWh)	10,485	15,136	10,842	12,485	679	10,067	12,117	2,843
Program Reported Demand Savings (MW)	4.68	7.84	165	79.4	0.05	4.20	1.24	0.19
Program RR, Energy	0.72	0.54	0.65	0.65	0.65	0.86	0.97	1.07
Program RR, Demand	0.18	0.15	0.01	0.02	1.36	0.22[c]	0.94	1.20
NTG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Program Net First Year Energy Savings (MWh)	7,590	8,241	7,047	8,140	443	8,647	11,765	3,047
Program Net First Year Demand Savings (MW)	0.83	1.20	0.99	1.75	0.06	0.91[c]	1.16	0.23
Net Verified Lifetime Energy Savings (MWh)	125,109	149,839	N/A	N/A	N/A	117,753	155,310	43,618

[a] PY2018 was a limited impact evaluation that leveraged previous years' evaluations to develop RRs for net verified first year savings.
[b] PY2019 and PY2020 true-up results are not included in this table.
[c] Weatherization measures did not include demand savings in the PY2019 evaluation. The values in this table reflect adjustments made to account for weatherization demand savings, which added a total of 14.4 kW in demand savings.

Figure 4 and Figure 5 show how the net verified first year savings and net verified first year demand have changed at the participant level over time. Values are derived by taking the aggregated verified net first year savings values over the number of participant projects for each year and each category. The different frameworks are presented separately within the figures. All categories have seen increases in PY2021 from PY2020 and PY2019 for the IF.

Figure 4: Verified First Year Net Energy Savings Per Participant (kWh/year)

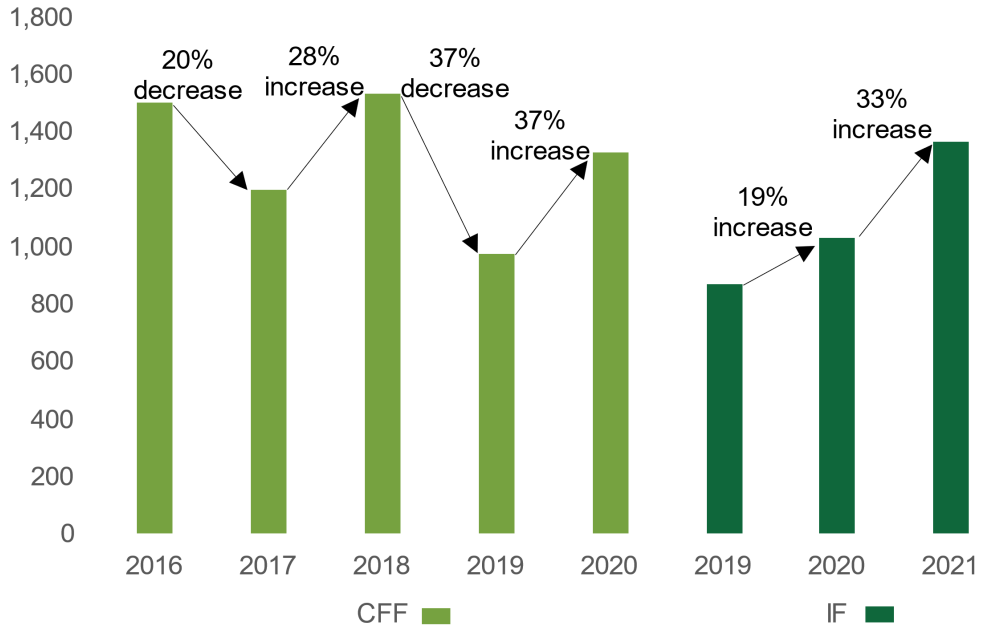


Figure 5: Verified First Year Net Demand Savings per Participant (kW/Year)

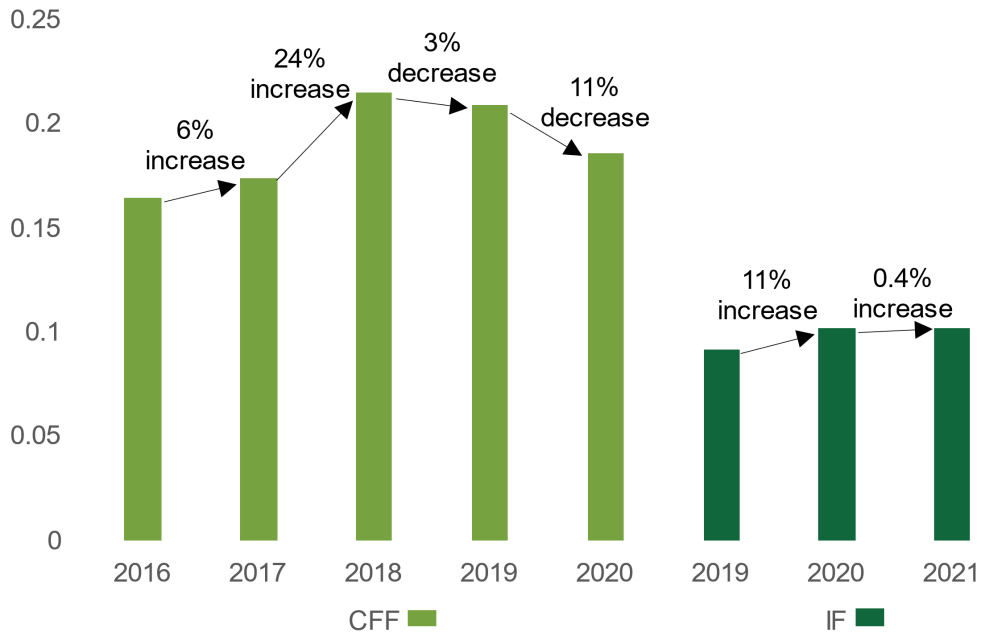
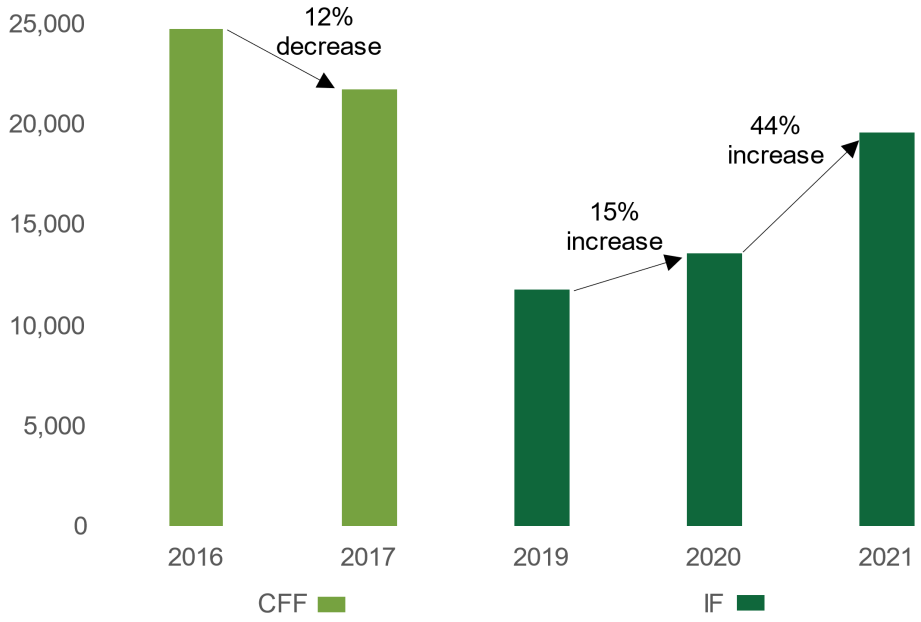


Figure 6 shows the net verified lifetime energy savings per participant. Note that lifetime savings values are not included in 2018 due to limited information on lifetime savings amounts. Lifetime savings per participant project increased by 44% in PY2021 for the IF.

Figure 6: Net Verified Lifetime Energy Savings Per Participant (kWh)



Section 4 Cost-Effectiveness Evaluation

This section presents the cost-effectiveness evaluation results. Details regarding the cost-effectiveness methodology can be found in Section 2.2 and Appendix A.2.

The cost-effectiveness results are presented in Table 5. The program did not pass the Total Resource Cost (TRC) test or the Program Administrator Cost (PAC) test because benefits were less than their respective costs for each test. This result is consistent with findings for low-income programs in other jurisdictions. Additionally, regulations in other jurisdictions commonly do not require low-income programs to meet cost effectiveness.[12]

Table 5: Program Level Cost-Effectiveness Key Metrics

Cost-Effectiveness Test	PY2019	PY2020	PY2021	Total
TRC				
TRC Costs ($)	7,767,042	13,818,653	4,301,631	25,887,326
TRC Benefits ($)	4,469,614	6,315,723	1,709,105	12,494,442
TRC Net Benefits ($)	-3,297,428	-7,502,930	-2,592,526	-13,392,884
TRC Net Benefit (Ratio)	0.58	0.46	0.40	0.48
PAC				
PAC Costs ($)	10,377,767	13,818,653	4,301,631	28,498,051
PAC Benefits ($)	3,481,016	5,093,366	1,421,236	9,995,618
PAC Net Benefits ($)	-6,896,751	-8,725,287	-2,880,395	-18,502,433
PAC Net Benefit (Ratio)	0.34	0.37	0.33	0.35
Levelized Delivery Cost				
$/kWh	0.12	0.13	0.15	0.13
$/kW	1,225.96	1,308.53	1,993.67	1,345.32

Between PY2020 and PY2021, both PAC costs and benefits fell: -69% for costs and -72% for benefits. Changes in TRC costs and benefits between PY2020 and PY2021 were almost identical to PAC, dropping -69% for costs and -73% for benefits. This indicates that while the program stayed at roughly the same cost effectiveness due to similar drops in costs and benefits, the program became slightly less cost effective in PY2021 compared to PY2020 due to relatively higher costs compared to benefits.

[12] *Guidelines for Low-Income Energy Efficiency Programs,* American Council for an Energy-Efficient Economy, https://database.aceee.org/state/guidelines-low-income-programs

For a more distinct comparison between program years, we can contrast PY2019 and PY2020. Between those years, PAC costs went up by 33% and benefits went up by 46%, indicating that the program had become more cost-effective from the program administrator's perspective. Contributing to this were the growth in benefits compared to costs of individual measures. Roughly three-fourths of the measures that were implemented in both PY2019 and PY2020 saw their measure-level PAC ratio go up by ten percent or more. Specifically, 11W and 23W ENERGY STAR qualified A shape lights, smart power bars, and indoor clothes drying racks contributed 72% of the program's PY2020 savings, and each measure saw a 10% or greater increase in its measure-level PAC ratio. At the opposite end of the spectrum, only seven measure-level PAC ratios went down between PY2019 and PY2020, and those measures only accounted for 3% of the PY2020 total energy savings. Notably, all three sizes of the room air conditioner measure were among these seven measures with dropping measure-level PAC ratios.

Figure 7 compares the frequency of incentive level per project in categories of $500 increments across PY2019, PY2020, and PY2021 and includes projects "trued up" from PY2019 and PY2020. Because PY2021's project quantity was substantially smaller than project quantities in PY2019 or PY2020, it is difficult to visually compare trends in Figure 7; therefore, Figure 8 presents these same results, but as a percent of the total project quantity in each program year.

PY2019 and PY2020 were similar to each other relative to PY2021, both in terms of volume of project quantities and distribution of project incentive amounts. Relative to PY2019, PY2020 showed a slight shift in project incentives, where a lower proportion of project incentives were less than $500 and a higher proportion of project incentives fell in the $500 to $1,500 range.

PY2021 included a much smaller quantity of projects, but those projects trended towards higher incentive amounts per project. Specifically, 67% of projects in PY2019 and 63% of projects in PY2020 had an incentive of less than $1,000, compared to 44% of projects in PY2021. Similarly, approximately 90% of projects in PY2019 and PY2020 had an incentive of less than $2,000, compared to 80% of projects in PY2021. With the program having fixed costs to operate, regardless of participation volume or depth of savings per site (e.g., program-level administration or technician cost per site), this trend towards larger project incentives can help minimize the impact fixed program costs (e.g., marketing, program-level administration, etc.) have on program-level cost-effectiveness.

As observed in previous HAP evaluations, the incentive per project is still well below the program's incentive cap. Since the program implements all applicable measures that the program offers and customers will accept, up to the program incentive cap of $13,000, this may be an opportunity for the program to offer new additional measures.

Figure 7: Frequency of Incentive Amount Per Project by Program Year

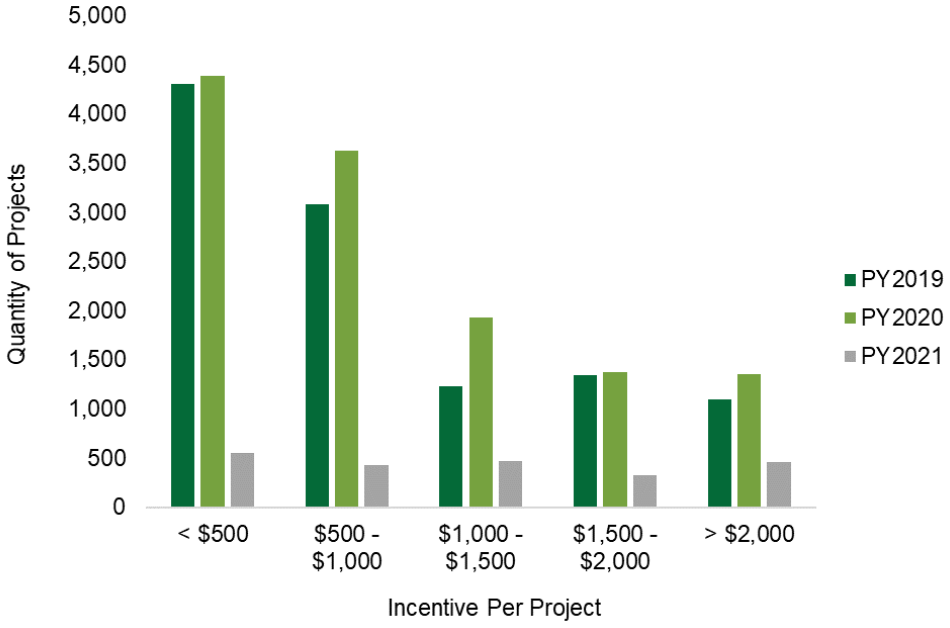
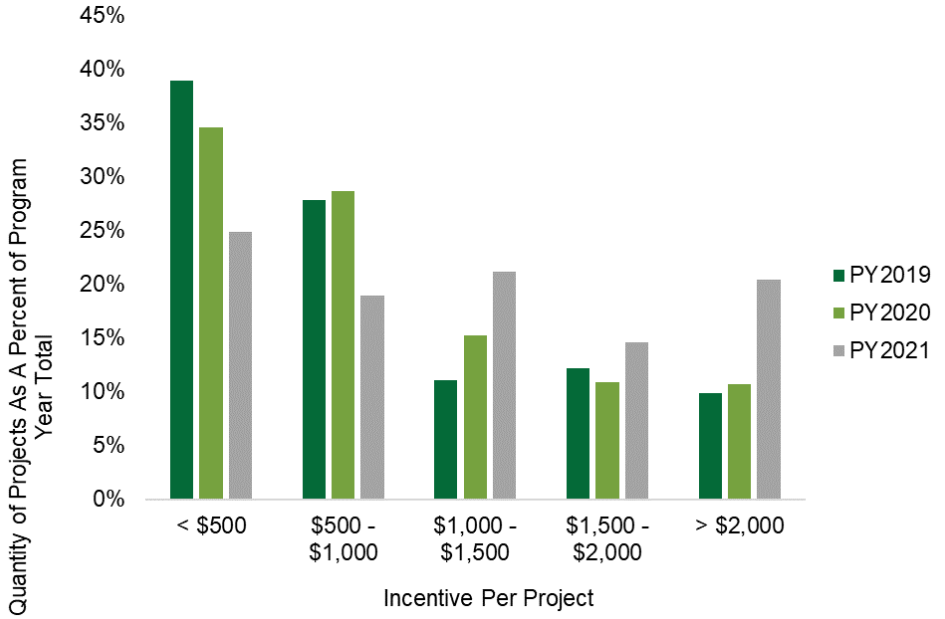


Figure 8: Frequency of Incentive Amount Per Project as a Percent of Program Year Total by Program Year



Section 5 Process Evaluation

This section presents the process evaluation results. Details regarding the process methodology can be found in Section 2.3 and Appendix A.3. Additional process evaluation results can be found in Appendix C.

5.1 IESO and Program Delivery Vendor Staff Perspectives

The following subsections highlight the feedback received from the IESO program staff and program delivery vendor staff about the design and delivery of HAP in PY2021.[13]

5.1.1 High-Level Results

High-level results from the IESO and program delivery vendor staff IDIs include the following:

- The program met both the IESO staff and delivery vendor staff's expectations for the year despite barriers associated with the COVID-19 pandemic, rising costs, and program saturation challenges. These findings are similar to PY2020, where COVID-19 and saturation challenges were major barriers to delivery. IESO staff indicated that customers appreciated the no-cost element and straightforward participation process in PY2021, which is consistent with feedback from prior years.
- Supply chain disruptions have had major impacts on program measure costs, especially for appliances and weatherization for the program in PY2021, in contrast to PY2019 and PY2020 when these disruptions were far less prevalent A more periodic review of program measure-related cost caps, including additional market research and cost evaluations of relevant program measures, was recommended by the program delivery vendor to help identify necessary cost cap updates.
- Delivery vendor staff recommended the program further considers how heat pumps could be included in future program years. Delivery vendor staff had also mentioned considering heat pumps for inclusion in the program in both PY2019 and PY2020 as well, since a similar program (the Affordability Fund Trust) had been in market at the time and was offering heat pumps.
- Delivery vendor staff stressed the importance of additional marketing of the program in future years, especially to help promote the Energy Saving Kits which saw lower demand than expected in PY2021 and to address concerns customers may have about the program's legitimacy. Increasing program marketing to further raise awareness of the program was also mentioned by delivery vendor staff in PY2019 and PY2020.

[13] Please note that the interviewed IESO program staff and program delivery vendor staff provided feedback for both HAP and EAP. EAP was offered for the first time in PY2021 and will replace HAP in future program years. Given the similarities between HAP and EAP, there is overlap across the IESO program staff and program delivery vendor staff results in PY2021.

5.1.2 Design and Delivery

IESO staff and delivery vendor staff both indicated that the program met their expectations in PY2021 despite the continued challenges associated with the COVID-19 pandemic. Delivery vendor staff indicated that having a single delivery vendor oversee program delivery across the entire province as they did in PY2021 was very effective. This delivery approach granted purchasing power to the delivery vendor, lead to reduced program confusion, and created a strong contractor network that was able to deliver a high-volume of measures in a timely manner. The delivery vendor staff also stated that they found the types and amounts of resources available through the program to largely be reasonable, though they noted that the recent supply chain issues have made it challenging to procure equipment at reasonable costs.

5.1.3 Customer Engagement

The delivery vendor staff reported that the program's eligible measures were well-aligned to meet customer needs. They indicated that customers typically participate to reduce their energy costs, likely exaggerated by higher home energy consumption during pandemic lockdowns when more people remained home. IESO staff noted that customers appreciate the no-cost element as well as the quality of customer service provided. Delivery vendor staff reported that the process to participate is not overly complicated, which helped to engage and retain participants. Delivery vendor staff also noted that community-focused outreach that IESO has recently undertaken has been effective in terms of further legitimizing the program to customers.

5.1.4 Barriers and Opportunities

The pandemic continued to present challenges to energy-efficiency programming in PY2021. For EAP, this resulted in many customer putting applications on hold, moving away, or wanting to delay or cancel their assessments. The delivery vendor staff reported developing even more stringent health and safety protocols to help protect customers and program delivery partners.

Both the IESO staff and delivery vendor staff indicated that the Energy Saving Kits were not as successful as anticipated in PY2021. IESO staff indicated that there is a narrow band of customers who are eligible for Tier 2 given different level of income across the province. Additionally, delivery vendor staff stated that a prior program not offered by IESO called the Affordability Fund Trust (AFT) had already serviced many moderate-income customers in prior years, which likely had an impact on the uptake of the Energy Saving Kits. Additional program marketing may have also helped to increase uptake of the Energy Saving Kits, according to program delivery staff.

Both IESO staff and delivery vendor staff stated that supply chain disruptions associated with the pandemic have led to delays in measure availability as well as increased manufacturer costs for many program measures, such as appliances and weatherization. They both noted a more periodic review of program measure-related cost caps is needed to meet rising costs, with IESO staff indicating that they may consider doing so on a bi-annual basis. Delivery vendor staff recommended that the IESO consider performing market research and cost evaluations of relevant program measures to help identify necessary cost cap updates.

Delivery vendor staff recommended further considering how heat pumps could be included in future program years, noting that they had been very well received when they had been offered

as part of the AFT. IESO staff indicated that they try to ensure that the program is as flexible as possible to meet customer needs while still ensuring they can manage program costs.

IESO staff reported that there are still many eligible customers who have not yet been served by the program, but, given that a version of this program and others like it (such as the AFT) have been in market for many years, many homes have already been served, and those remaining homes are likely harder to reach. IESO staff have introduced new initiatives to overcome these challenges including a roundtable forum of sector experts called the Energy Affordability Roundtable that meets quarterly. IESO's recent collaborations with gas utilities and community organizations like the charity the Omega Foundation have also increased program awareness and participant leads.

Delivery vendor staff stressed the important of continuing to increase program visibility through additional marketing and outreach in future program years, especially for the Tier 2 offering.

5.2 Auditor and Contractor Perspectives

The following subsections highlight the feedback received from the auditor and contractor survey. Additional results can be found in Appendix C.1.[14]

5.2.1 High-Level Results

High-level results from the auditor and contractor survey include the following:

- Auditors and contractors nearly always informed customers about the program (average rating of 4.3 on a scale of 1 to 5, where 1 meant "never" and 5 meant "always"). The rate at which auditors and contractors informed customers about the program has remained consistently high over time, with averages of 3.6 in PY2019 and 4.3 in PY2020.
- Auditors and contractors were satisfied with the training and support provided by the program delivery vendor in PY2021 (average rating of 4.4 on a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "very satisfied"). Auditor and contractor satisfaction has also remained consistently high over time, with averages of 4.8 in PY2019 and 4.6 in PY2020.
- Auditors and contractors perceived the greatest barriers to program participation to be lack of awareness (mentioned by 71% of respondents) and concerns whether the programs were real (mentioned by 61% of respondents). These have been the top two barriers mentioned by auditors and contractors each year since PY2019. However, the percent of auditors and contractors citing concern over the program's legitimacy (61%) decreased from 82% in PY2021.
- Over one-fourth (26%) of respondents reported that the program's measure eligibility criteria (e.g., restrictions on appliance sizes, equipment age, equipment variety, insulation variety, fuel sources, metering requirements for certain equipment) have led to decreases

[14] Please note that the surveyed auditors and contractors provided feedback for both HAP and EAP. EAP was offered for the first time in PY2021 and will replace HAP in future program years. Given the similarities between HAP and EAP, there is overlap across the surveyed auditors and contractors results in PY2021.

in the frequency with which measures are installed, with appliances and insulation most often mentioned as being negatively impacted.

- Close to one-third (32%) of respondents shared recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue, with most recommending insulation cost cap adjustments and as well as taking travel costs into account as fuel costs increase.
- Auditors and contractors provided recommendations for program improvement with most of the recommendations relating to improving the outreach and marketing of the program as well as increasing the funding of the program. Increasing marketing efforts was among the top two recommendations from auditors and contractors for overcoming participation barriers in PY2019 and PY2020.

5.2.2 Auditor and Contractor Profile

Of the 31 respondents who completed the survey, 17 performed in-home energy audits (auditors), 13 installed program-eligible equipment (contractors), and one individual did both. Responding auditors and contractors indicated that they have an average of 19.6 full time employees and 1.4 part time employees working at their company. The average number of years respondent companies had been in business was 12.

5.2.3 Program Barriers

The most commonly identified barriers to program participation as reported by the surveyed auditors and contactors were low program awareness among customers (71%), followed by skepticism of the program's legitimacy (e.g., distrust that the program is real or is free) (61%). Over one-fourth of respondents (29%) noted that they believe customers do not think the upgrades are worth the trouble of participating. For example, one respondent mentioned that several customers almost did not participate after they were informed upon signing up that a mandatory hole would be drilled into their walls to verify the insulation levels for the weatherization assessments. The most common recommendations for overcoming barriers to program participation was to increase marketing (suggested by 51% of respondents). Some respondents offered specific marketing and outreach suggestions, such as including community organizations or volunteers into the marketing and outreach. Over one-tenth (13%) of respondents recommended providing more information to customers like the effectiveness and cost-saving potential. A full list of program barriers and recommendations to address barriers can be found in Figure 36 and in Figure 37 in Appendix C.1.2.

Barriers to Participation	
Unaware of the program	✓
Concern about program legitimacy	✓
Did not think upgrades were worth the trouble of participating	✓
Did not prioritize getting efficiency upgrades given other priorities	✓
Income qualification requirement	✓
COVID-19	✓
Other work required to prior to making program upgrades	✓
Did not think upgrades would save them money	✓

5.2.4 Measure Eligibility Criteria

Surveyed auditors and contractors shared their perspectives on how the program's measure eligibility criteria affected the frequency with which program measures were installed, with approximately one-third of respondents (11 out of 31) providing feedback.

Three respondents reported that the program's eligibility criteria have had a positive impact on the frequency of measure installations. One respondent indicated that the program's measure eligibility criteria help the auditors and contractors focus on serving homes that have the least efficient or oldest equipment rather than serving homes that may have newer appliances.. The other two respondents noted that additional appliance models are now covered by the measure eligibility criteria, which has led to additional appliance installations..

However, most of these respondents (eight out of 11), reported that measure eligibility criteria have decreased the frequency with which program measures are installed (e.g., restrictions on appliance sizes, equipment age, equipment variety, insulation variety, fuel sources, metering requirements for certain equipment), with appliances and insulation most often mentioned as being negatively impacted. One respondent noted that the measure eligibility requirements for refrigerators and freezers related equipment age mean that many customers are ineligible for these upgrades even though the equipment is often close to 20 years old. Additional feedback about the measures affected by the measure eligibility criteria can be found in Table 21 in Appendix C.1.3

Over two-fifths of respondents (13 out of 31) suggested adjustments to measure eligibility criteria for program to consider in future years. The most common suggestion was to relax the requirement for cooling equipment (three respondents) by allowing equipment with lower EER ratings to qualify. One respondent noted, "The current EER rating [for air conditioners] excludes most or all [of them]. In the more than 4,000 assessments I have done, I believe I have only seen about five [air conditioners] that met the criteria". Additional feedback about suggestions for adjusting the measure eligibility criteria can be found in Table 22 in Appendix C.1.3

5.2.5 Measure-Related Cost Caps

Surveyed auditors and contractors shared recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue, with close to one-third providing feedback (ten out of 31). Most of these respondents (7 respondents) recommended adjustments to the cost caps for insulation, with one respondent noting that "the material cost of insulation is rising faster than the program caps". Three respondents

Measure Cost Cap Recommendations	
Adjust insulation cost caps	✓
Account for fuel travel costs	✓
Review appliance cost caps	✓
Increase cost caps	✓
Lower cost caps	✓
Review air sealing cost caps to ensure they cover blower door tests and thermal cameras	✓
Review cost caps every six months	✓

recommended that the program take travel costs into account as fuel costs increase. One respondent also suggested the cost caps for appliances be reviewed as many newer appliances are being left out. Additional feedback recommendations for measure related cost caps can be found in Table 23 in Appendix 5.2.5.

5.2.6 Recommendations for Program Improvement

Over three-fourths (24 of 31) of respondents provided recommendations for energy-efficient equipment or services that they would like to see included in the program, with one-third (33%) of these respondents recommending heat pumps, respondents noted air-source heat pumps, cold climate air source heat pumps, and ground source heat pumps. Less than one-third (29%) of respondents recommended kitchen equipment such as dishwashers and stoves. Respondents also recommended washers and dryers (21%), insulation and air sealing (17%), and heating equipment (13%) such as boilers and baseboards. Additional feedback on recommendations for additional program equipment or services be found in Figure 38 in Appendix C.1.5.

Over one-half (17 of 31) of respondents provided recommendations for improving the program. Of these, six respondents (35%) recommended increased outreach and marketing, and two respondents each (12%) recommended increasing the funding to pay auditors and contractors more fairly and to avoid switching service providers. Respondents also recommended better training, improvements in the program software, and including more qualification questions in the customer screening process, among others. Additional feedback on recommendations for additional program equipment or services be found in Table 24 in Appendix C.1.5.

Program Improvement Recommendations	
Improve outreach and marketing	✓
Increase funding for auditors and contractors	✓
Avoid switching service providers	✓
Implement better training	✓
Improve program software	✓
Include more qualification questions in the screening process	✓
Remove blower door service	✓
Change metrics for energy saving	✓
Cap the number of audits per day	✓
Better prepare clients for site visits	✓

5.3 Participant Perspectives

The following subsections highlight the feedback received from the participant survey. Results are presented either as percentages or counts, depending on sample size. Additional results can be found in Appendix C.2.

5.3.1 High-Level Results

High-level results from the participant survey include the following:

- Most participants heard about the program through bill inserts (37%) or from friends/family (24%) and applied online (49%). These findings are consistent with PY2019 and PY2020, wherein bill inserts and friends/family were the top two ways participants heard about the program and online was the most common method for applying.

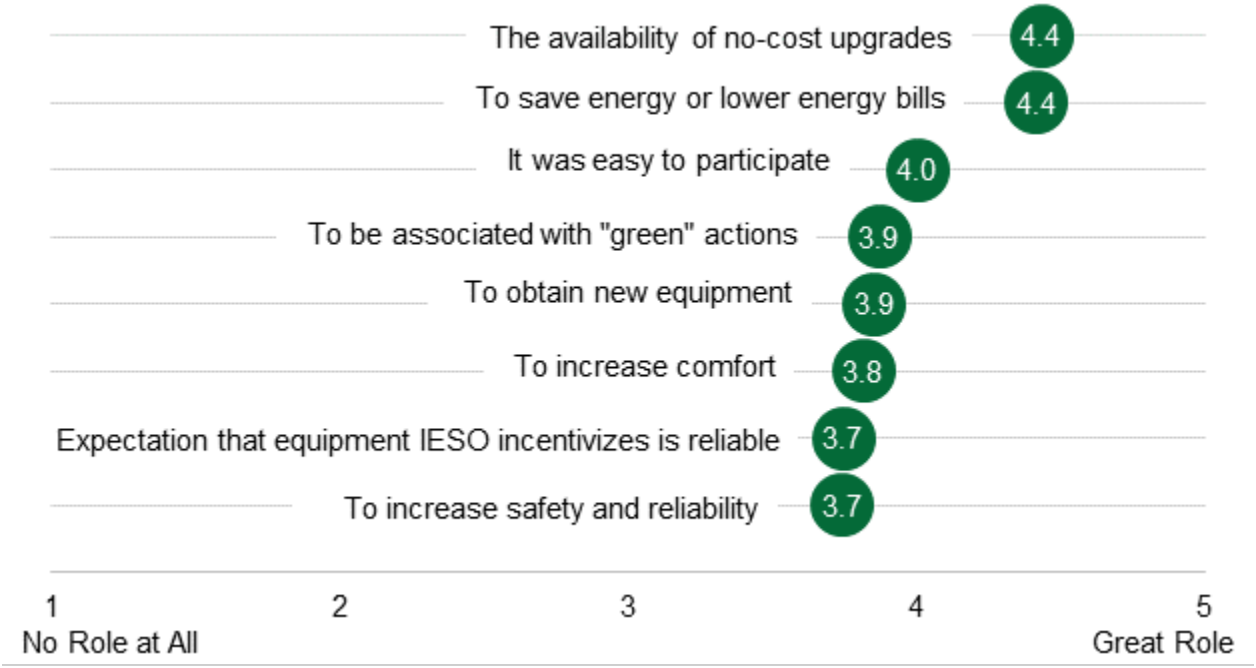
- Their primary motivations for applying were (1) the availability of the no-cost upgrades and (2) to save energy or lower energy bills (average ratings of 4.4 on a scale from 1 to 5, where 1 meant the motivating factor played "no role at all" and 5 meant it played "a great role"). These have consistently been the top two motivations for applying to the program since PY2019.
- Just over one-half (53%) of respondents said their energy auditor discussed additional ways to save energy at the time of the audit. Of these respondents, most (94%) had tried at least one of them since having the audit performed. The percent of respondents reporting that their energy auditor discussed additional ways to save energy (53%) declined from 65% in both PY2019 and PY2020. It may be that auditors and contractors performed their work as quickly as possible and spent less time speaking with participants in order to minimize exposure to COVID-19.
- Respondents were largely satisfied with the program overall (average rating of 4.3 on a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "completely satisfied"). They were especially satisfied with the professionalism of their auditor (average rating of 4.6). While perceived energy affordability improvements was the program aspect participants were least satisfied with, this was still rated highly (average rating of 4.2). These findings are consistent with PY2019 and PY2020, wherein overall satisfaction was high (average rating of 4.3 or 4.4), participants were most satisfied with the professionalism of their auditor, and least satisfied with perceived energy affordability improvements.
- Seventeen percent of respondents offered recommendations for improving the program. The most common recommendations were to ensure auditors and contractors are properly trained (ten respondents) and to provide higher quality measures (eight respondents). The percent of respondents that recommended relaxing eligibility requirements for specific measures declined from 22% in PY2020 to 11% in PY2021. This may be due to program improvements in communicating measure eligibility and accurately setting customers' expectations (a PY2020 recommendation).
- Over one-half (54%) of respondents provided recommendations for additional energy-efficiency equipment or services for inclusion in HAP. Participants often recommended doors, windows, insulation, stoves/ranges, clothes washers/dryers, and dishwashers. Additional appliances and weatherization measures have consistently been the top two categories of recommended equipment since PY2019.

5.3.2 Program Awareness and Motivation

Most respondents heard about the program through bill inserts (37%) or from friends or family (24%). Around one-half (49%) of respondents applied for the program online. Additional feedback on how participants heard about and applied to the program can be found Figure 47 and Figure 48 in Appendix C.2.2.

Figure 9 displays respondents' average ratings for the level of influence various factors had on their decision to participate in the program. Respondents rated the influence of each factor using a scale from 1 to 5, where 1 meant "no role at all" and 5 meant "a great role." The most influential factors were (1) the availability of the no-cost upgrades and (2) to save energy or lower energy bills, each with an average rating of 4.4.

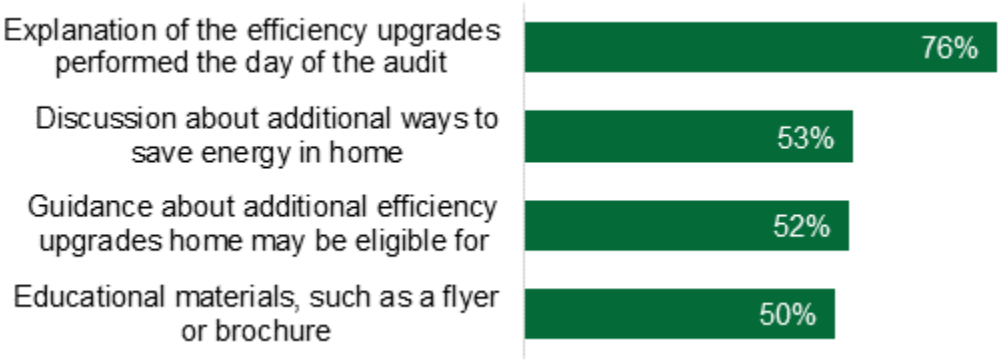
Figure 9: Factors Influencing HAP Participation (n=319)



5.3.3 Program Education and Behavioral Changes

Energy auditors provided various resources to participants at the time of the audit. As shown in Figure 10, around three-fourths (76%) of respondents said the auditor explained the efficiency upgrades performed the day of the audit. Additionally, around one-half of respondents said the auditor discussed additional ways to save energy (53%), offered guidance about additional upgrades for which they may be eligible (52%), or provided education materials, such as flyers or brochures (50%). Respondents found these resources useful: the average rating was 3.9 on a scale from 1 to 5, where 1 meant "not at all useful" and 5 meant "very useful."

Figure 10: Resources Provided by Energy Auditor (n=319; Multiple Response)*



*Does not sum to 100% due to multiple response.

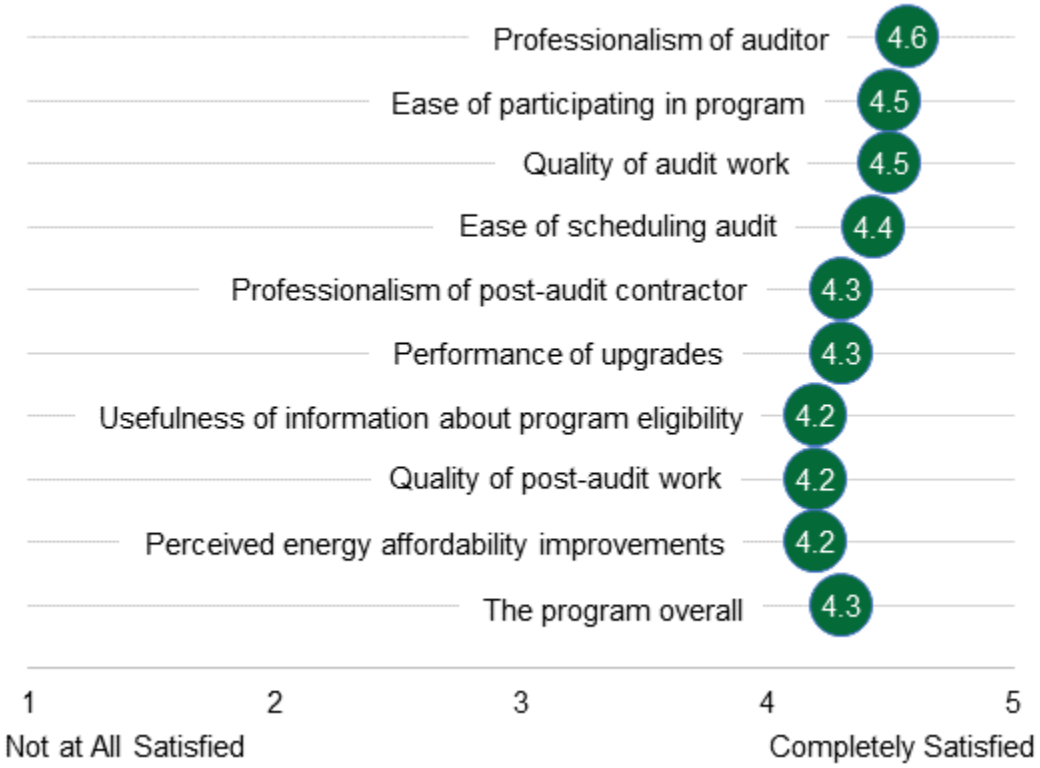
Responding participants provided feedback about the additional energy-saving methods that their auditor suggested. The most frequently suggested methods were to buy ENERGY STAR appliances and hang laundry to dry: over one-half of respondents said their auditor suggested these. Between one-third and one-half of respondents said their auditor suggested installing a programmable thermostat (45%), turning off or unplugging appliances and electronics (40% and 35%, respectively), sealing air leaks (40%), and washing laundry with cold water (38%). Respondents found this information useful: the average rating was 4.0 on a scale from 1 to 5, where 1 meant “not at all useful” and 5 meant “very useful.” Most respondents (94%) whose auditor discussed additional ways to save energy had tried at least one of them since having the audit performed. Additional feedback on other energy-saving methods suggested and tried can be found in Figure 50 in Appendix C.2.3.

5.3.4 Program Satisfaction

Most respondents were satisfied with the program. Figure 11 displays respondents’ average satisfaction ratings with various aspects of the program and the program overall on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied.” The average rating for the program overall was 4.3. Around four-fifths (81%) of respondents said they were likely to recommend the program to others.

The program aspects respondents were most satisfied with were the professionalism of the auditor (4.6), ease of participating in the program (4.5), and the quality of the audit work performed (4.5). No individual aspects of the program had an average rating below 4.0.

Figure 11: Satisfaction with Program Aspects (n=319)



5.3.5 Recommendations for Program Improvement

Close to one-fifth of the respondents (54 out of 319) offered recommendations for improving the program (Figure 12). The most common recommendation was to ensure auditors and contractors were properly trained, suggested by ten respondents (19%) who had had negative experiences such as rushed audits or property damage from installation. Eight respondents (15%) recommended higher quality measures after experiencing issues such as LEDs flickering, appliances breaking, or receiving damaged appliances. Seven respondents (13%) recommended better instructions for using the programmable thermostats, while another seven respondents reported not receiving promised items.

> It was not explained how to operate the thermostats. I had to ask the tech to leave information booklets as they were leaving…Still not sure how to operate the devices.

Figure 12: Recommendations for Program Improvement (n=54; Multiple Response)*

*Does not sum to 100% due to multiple response.

Around one-half of the respondents (171 out of 319) provided recommendations for additional energy-efficiency equipment or services for inclusion in the program. Over one-half (53%) of these respondents recommended additional weatherization measures, including windows, doors, and insulation. Two-fifths (40%) recommended appliances such as stove/ranges, clothes washers/dryers, and dishwashers, while another two-fifths (40%) recommended water heating equipment. Over one-third of the 171 respondents recommended cooling (39%) or heating (36%) equipment. Additional feedback on these recommendations can be found in Figure 51 in Appendix C.2.4.

Section 6 Other Energy Efficiency Benefits

This section presents results related to the program's other energy efficiency benefits including avoided greenhouse gas emissions and the jobs impact analysis.

6.1 Avoided Greenhouse Gas Emissions

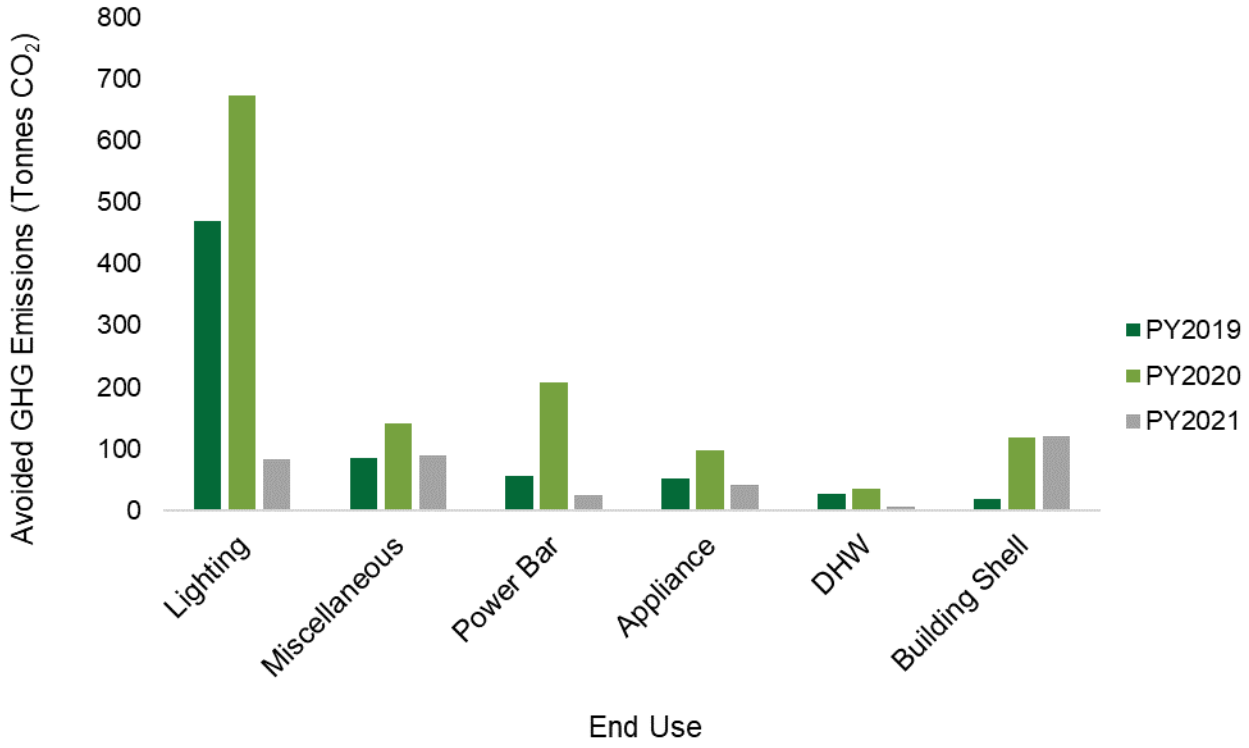
The NMR team used the IESO's *Cost Effectiveness Tool* to calculate avoided GHG emissions. The NMR team calculated avoided GHG emissions for the first year and for the lifetime of the measures. Table 6 presents the results of these calculations for PY2019, PY2020, and PY2021.

Table 6: Avoided GHG Emissions by Program Year

Avoided (Tons CO_2 equivalent)	PY2019	PY2020	PY2021	Total
First Year	706	1,274	364	2,344
Lifetime	16,470	22,718	6,820	46,008

Figure 13 compares avoided GHG emissions by end use and program year. While PY2021's savings, and thus avoided GHG emissions, were lower compared to previous program years, a key trend occurred over the three program years. The lighting end use's relative contribution to program-level avoided GHG emissions diminished from 66% in PY2019 to 53% in PY2020 and finally to 23% in PY2021. Conversely, the building shell end use's relative contribution to program-level avoided GHG emissions increased from 3% in PY2019 to 9% in PY2020 and finally to 33% in PY2021. Moreover, despite the program-level avoided GHG emissions dropping 71% between PY2020 and PY2021, the building shell end use's avoided GHG emissions went up by 1% between the same two program years.

Figure 13: Avoided GHG Emissions by End Use and Program Year



6.2 JOBS IMPACT ANALYSIS

This section outlines the jobs impact analysis results. Details regarding the jobs impact analysis methodology can be found in Section 2.4 and Appendix A.4.

6.2.1 High-Level Results

- The analysis used an input-output model which estimated that HAP will create 58 total jobs in Canada, of which 52 will be in Ontario.
- Most of the jobs stem from the demand created for energy-efficient products and services related to their program delivery
- HAP is estimated to create approximately 10.2 jobs per $1M of program spend, compared to 10.0 jobs per $1M in 2020.

6.2.2 Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from HAP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 7 shows the input values for the demand shock representing the products and services related to HAP. Each measure installed as part of HAP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 7: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Electric light bulbs and tubes	302	0	302
Major appliances	2,300	292	2,592
Non-metallic mineral products, n.e.c.	209	486	695
Other miscellaneous manufactured products	60	0	60
Small electric appliances	100	100	199
Switchgear, switchboards, relays and industrial control apparatus	326	223	548
Other professional, scientific and technical services	-	-	279
Office administrative services	-	-	988
Total			**5,663**

Table 8 shows the calculations and input value for the household expenditure shock.[15] This shock represents the net additional amount that households would inject back into the economy through spending. Additional background and details about the shock inputs can be found in Appendix D.

Table 8: Summary of Input Values for Household Expenditure Shock

Description	Total Shock ($ Thousands)
NPV of energy bill savings	6,111
Residential portion of program funding	(1,982)
Net bill savings to residential sector	**4,128**
Percent spent on consumption (vs. saved)	36%
Total Shock	**1,484**

[15] The model is actually run with a normalized value of $1 million in extra household expenditures and the job results can be scaled by the actual demand shock.

6.2.3 Model Results

Impacts from the StatCan I-O model are generated separately for each shock and added together to calculate overall program job impacts. In the case of HAP, this means that two different sets of job impacts are combined into the overall jobs impacts. Table 9 shows the total estimated job impacts by type – combining the impacts from the demand and household reinvestment shocks. The majority (52 out of the 58 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 11 out of 12 indirect and 9 out of 12 induced total jobs created within the province. The FTE estimates are slightly less, with a total of 41 FTEs (of all types) created in Ontario and 46 FTEs added throughout Canada. Calculating relative program performance as a function of jobs created per $1M of program budget is helpful in comparing different program years. HAP was estimated to create 10.2 total jobs per $1M of investment in 2021, compared to 10.0 jobs per $1M in 2020. Additional model results can be found in Appendix D.

Table 9: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* *Total*	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total	Total Jobs per $1M Investment *(in person-years)*
Direct	23	23	28	28	4.9
Indirect	9	12	14	15	2.6
Induced	4	10	10	15	2.6
Total	**41**	**46**	**52**	**58**	**10.2**

6.3.4 Survey Responses on Job Impact Questions

The HAP auditor and contractor survey contained job impact-related questions for auditors and contractors related to the impact of HAP on their firms and employment levels. Two questions in particular were informative to understand the nature of the impacts to respondents, which would be considered direct impacts. These two questions are below, with relevant illustrative verbatim survey responses included:

1. Did the 2021 Home Assistance Program help or hinder the growth of your business in any way? If so, please explain how.

   The program helped the growth of my business in the following ways:

   - *"The program helped us grow as a company as we had to employ more people."*
   - *"It is my only source of income."*
   - *"Consistent workload, stable income."*
   - *"As a registered Energy Advisor I was able to communicate to customers the existence of other incentive programs and in some cases I was able to help them get involved in other energy savings programs.*

- *"Provided us with a lot of business, really helped us in 2018 when we were a smaller company."*

The program hindered the growth of my business in the following ways:

- *"While it was nice to be involved with this program, I lost higher paying jobs as a result of scheduling conflicts. Energy audits for HER and CGHG programs pay double for the same amount of time and with fuel costs the way they are, it is not feasible for me to continue to help deliver this program. This sentiment is shared by many advisors that were at one time or another involved in HAP or similar programs."*
- *"Slow payment times impact our profitability."*
- *"It did not hinder but because of the amount of assessment it did prevent me from doing other work."*

2. Did the 2021 Home Assistance Program have an impact on the number of people you hired in the last year? Yes, the program impacted the number of people hired in the last year in the following ways:

Positive Impacts:

- *"Yes, many times (not always) I have hired workers to assist me in my jobs so I could do more in a day. I have hired 2 people for about 60 days of work."*
- *"It did impact as we had to hire more people to help out with the extra work."*
- *"Added two employees."*
- *"Hired 3 more people."*

Negative Impacts:

- *"Unfortunately with the end of the program on our end we let them go."*
- *"I had to let one person go."*
- *"I don't hire people."*

Responding auditors and contractors indicated that the program generally had allowed them to add personnel to meet the demand for new work from HAP, as well as providing a steady revenue source – in the case of one respondent, the amount of work was enough that it was their only source of revenue. The direct job gains estimated by the model are generally supported by the responses, which reveal the nature of the actual impact on firms. The respondents who indicated loss of personnel did not give reasons for these negative responses, with the exception of one respondent who indicated that the reason for the job loss was due to no longer being involved in the program. The negative issues could be examined further if there was a focus on redesigning certain aspects of the program to enhance job impacts.

Section 7 Key Findings and Recommendations

This section presents detailed key findings and recommendations for the PY2021 evaluation. Please note that, given the nature of Findings 11 and 12, the team does not provide related recommendations.

***Finding 1:* HAP saw the lowest number of participants and the smallest amount of net verified savings but had the largest savings on a per-project basis when compared to previous program years.** In 2021, HAP completed 2,234 projects in 2,234 homes. The decrease in participation may be attributed to the last year of the framework and the addition of a new program offering, EAP, which also targets income-eligible participants in IESO territory. In addition, the ongoing COVID-19 pandemic may have affected participation. The program achieved first year net verified energy savings of 3,047 (MWh) and 0.23 MW of first year net verified demand savings. Verified energy savings on a per-project basis increased in PY2021 by 33% from PY2020 and 58% from PY2019 levels (866 kWh in PY2019, 1,028 kWh in PY2020, and 1,364 kWh in PY2021) despite shrinking baselines, such as those associated with lighting end-uses which have historically contributed to the majority of HAP savings.

- **Recommendation 1.** Continue to promote and deliver deeper savings measures (e.g., weatherization, appliances, and smart power bars) to income-eligible participants, especially in historically underserved areas. The NMR team understands that IESO conducted a limited geospatial analysis to help identify where the program has historically operated and to help increase participation. Monitoring the outcome of these efforts can inform whether additional geospatial analysis could help determine whether the program is effectively reaching historically underserved communities. Future iterations of this program could monitor both geographic reach and the extent to which measures with greater savings are delivered to underserved areas and how they are contributing to savings goals. The program could refine and expand geo-targeting efforts informed by the previous effort. This may help encourage targeted marketing and outreach campaigns that build community trust in IESO programs and result in increased participation in key areas. In addition, improvements in tracking data (refer to Recommendations 2a and 2b) can be used to determine whether certain geographic areas have higher concentrations of electric heating and water heating equipment.

Finding 2: HAP program tracking data includes a mixture of completed and incomplete projects including both installed measures and measures waiting to be installed, along with unique identifiers for each. However, the tracking data does not typically include key characteristics collected during audits such as building or equipment type. This information could be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms used during in-home audits. However, only in some cases is this information captured in the program tracking data. For example, 20% of HAP participant records were missing building type

information and no mechanical equipment details are included in the data. If additional programming is offered in the future, additional measures such as cold-climate heat pumps or heat pump water heaters may be offered. These additional data points will be valuable for program staff, vendors, and the evaluation team to assess the impacts of any new measures. The program tracking data included a mix of completed and incomplete projects, as well as installed measures and those measures waiting to be officially installed. The tracking data included variables to identify unique projects and measures, and separate variables to determine the level of completion a project had obtained. These unique identifying variables are critical for impact accounting over multiple years in a framework. However, since the tracking data was not limited to completed projects, the IESO and NMR evaluation teams were required to piece together which measures and projects were completed during PY2021. The remaining projects and measures that were incomplete at the time of the PY2021 evaluation will be included in the PY2022 evaluation.

- **Recommendation 2a.** In future versions of this program, continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

- **Recommendation 2b.** Work with program staff and implementation contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data collected on-site (e.g., efficiency, capacity). This could include revising the IESO's Field Audit Support Tool (FAST) program or supporting the development of a new uniform electronic data collection form for auditors to fill out on-site, which can then be uploaded directly into the tracking data.

Finding 3: In PY2021, there were 220 weatherization projects completed and savings deepened on a per-project basis compared to PY2020. Gross verified savings for weatherization measures were higher on a per-unit basis in PY2021 compared to PY2020 and PY2019 (1,939 kWh in PY2019, 2,400 kWh in PY2020, and 2,458 kWh in PY2021). This is in part due to increased savings associated with weatherization measures on a per-project basis (4,333 kWh in PY2021 compared to 3,669 kWh in PY2020 and 3,240 kWh in PY2019). The total savings from weatherization measures decreased by 7% from PY2020, but the proportion of program savings attributed to weatherization measures increased in 2021 (from 9% to 31%).

- **Recommendation 3.** Weatherization upgrades can provide important savings opportunities and health upgrades for participants. It will be important for future iterations of the program to emphasize and implement weatherization upgrades to participants as savings from lighting measures continue to diminish over time. The program could consider pushing shell insulation, especially attic insulation, to increased levels of efficiency to further deepen savings and increase occupant comfort and health benefits. Furthermore, with weatherization measures yielding measure-level total resource cost (TRC) ratios between 0.83 and 0.98, as compared to 0.40 for the total program, increasing weatherization measure implementation would lead to higher program-level cost effectiveness.

Finding 4: Participants, auditors, contractors, and delivery vendor staff recommended offering additional equipment through the program. Over one-half (54%) of surveyed participants provided recommendations for additional energy-efficiency equipment or services for inclusion in HAP. These participants most often recommended weatherization measures (53% of respondents), including windows and doors. Over three-fourths (77%) of auditors and contractors recommended additional equipment or services, including heat pumps (29%), kitchen equipment such as dishwashers and stoves (29%), washers and dryers (21%), insulation and air sealing (17%), and heating equipment (13%). Delivery vendor staff also recommended that the program consider the feasibility of offering heat pumps and generally revisit eligible measure offerings more frequently.

- **Recommendation 4a.** Consider offering additional types of equipment, such as kitchen equipment, washers and dryers, windows, doors, additional insulation and air sealing, heating and cooling equipment (such as heat pumps), and water heating equipment. Recommendations 1, 3, and 6 provide additional insight on new measures or services to consider adding to the program. As mentioned in the previous recommendation, additional weatherization measures would likely increase program-level cost effectiveness. Space heating and cooling measures yielded TRC ratios at or below the program-level TRC ratio in PY2021. Therefore, adding more space heating and cooling measures would likely negatively impact program cost effectiveness. Similarly, kitchen equipment already included in HAP (i.e., freezers and refrigerators) have generally delivered the lowest measure-level TRC test ratios, so adding similar measures to HAP would likely negatively impact program-level cost effectiveness.
- **Recommendation 4b.** Revisit eligible measure offerings more frequently.

Note that a similar recommendation to Recommendation 4a was included in the PY2019 and PY2020 evaluations. In response to the recommendation in PY2020, the IESO indicated that they had reviewed opportunities to expand the program measure composition and had considered the inclusion of the recommended equipment. They noted that, following this review, IESO had determined that the HAP measure composition was appropriately balanced in providing participants with attractive measures and impactful energy savings while meeting program and policy objectives and managing costs. Offering additional equipment through the program was still a common participant suggestion from PY2021 participants, auditors, and contractors, and additional measures, such as heat pumps, were mentioned more commonly. Therefore, this recommendation is provided again in PY2021 in case new opportunities exist to consider additional equipment types for program inclusion.

Finding 5. Participants recommended ensuring that auditors and contractors are properly trained. Close to one-fifth of participants (17%) offered recommendations for improving the program. Of those, close to one-fifth (19%) based their recommendations on a negative experience with an auditor or contractor, the most common of which was a rushed or incomplete audit.

- **Recommendation 5.** Reinforce audit protocols in training materials and communications with auditors. Consider providing a one-page visual or checklist of audit steps.

Finding 6: Project costs remained generally well below the program cap, but increased weatherization measures have pushed project cost upwards in PY2021. Approximately two-thirds of projects in PY2019 and PY2020 had an incentive of less than $1,000, compared to 44% of projects in PY2021. Similarly, approximately 90% of projects in PY2019 and PY2020 had an incentive of less than $2,000, compared to 80% of projects in PY2021.These higher project costs are due to the increased quantity of weatherization measures in 2021. This trend is encouraging, since as indicated in this and previous HAP evaluations, weatherization measures offer deeper savings along with added comfort benefits to customers. However, project costs are still well below the program cap. Since the program provides all eligible measures that each participant will accept, this finding suggests that there may be additional savings opportunities for measures not currently offered by the program.

- **Recommendation 6.** Continue to drive deeper savings with weatherization measures. Consider expanding the measures offered by the program, as this may provide deeper savings per home. Recommendations 1, 3, and 4 provide additional insight on new measures or services to consider adding to the program.

Finding 7: Additional program promotion opportunities exist. Common program barriers identified by IESO program staff and delivery vendor staff were the relatively minimal marketing and a lack of awareness that the program exists among customers. Auditors and contractors reported that the greatest barriers to program participation were lack of awareness (mentioned by 71% of respondents) and concerns among customers about whether the programs is real (mentioned by 61% of respondents). Improvement suggestions identified by IESO program staff and delivery vendor staff included continuing collaborations with the roundtable of sector experts and community-based groups, identifying partnership opportunities with gas utilities, and addressing gaps in marketing.

- **Recommendation 7a.** Consider additional ways to market and promote the program, such as through potential collaborations with gas utilities or increased province-wide marketing (e.g., social media campaigns, targeted advertisements).
- **Recommendation 7b.** Continue collaborations with sector roundtable and community-based organizations to help promote the program and address concerns about the program's legitimacy.

Please note that similar recommendations to Recommendation 7a and 7b were included in the PY2019 and PY2020 evaluations. In response to the recommendation in PY2020, the IESO indicated that program awareness-building and marketing campaigns were underway as part of the new framework and that these campaigns would be testing effective ways of reaching prospective participants in a targeted and cost-efficient manner. The IESO also indicated they would continue to engage local agencies and community organizations directly. They noted that the IESO established the Energy Affordability Roundtable to help build credibility and drive

participation in the new program and build relationships within the sector and said that the IESO also intends to collaborate with Enbridge Gas to reach shared customers more effectively. Given that minimal marketing and lack of program awareness were common barriers highlighted again in PY2021, we make the same recommendation to ensure that it continues to be considered in future iterations of the program.

Finding 8: Energy-efficiency education activities are likely resulting in savings. Just over one-half (53%) of respondents said their energy auditor discussed additional ways to save energy at the time of the audit. Of these respondents, over four-fifths (83%) had tried at least one of them since having the audit performed.

- **Recommendation 8.** Consider ways to analyze and quantify the energy savings resulting from the program's energy education activities.

Please note that a similar recommendation to Recommendation 8 was included in the PY2019 and PY2020 evaluations. In response to the recommendation in PY2020, the IESO indicated that they would work with evaluators to identify ways to capture additional savings from the program's education activities. They also noted IESO's non-energy benefits (NEBs) study could also potentially offer opportunities to capture benefits from these activities where savings are difficult to quantify. Given that participant feedback to the PY2021 survey indicates that the educational components of HAP are again likely resulting in savings, this recommendation is provided again in PY2021 to ensure that it continues to be considered in future iterations of the program.

Finding 9: Power bar measures had extremely high RRs. The NMR team found discrepancies with smart power bar savings values. The reported energy savings for smart power bars applied a savings value associated with the power bar with timer measure, which is no longer delivered by HAP. In addition, there were no demand savings reported for smart power bars, which prevented a demand RR from being calculated for smart power bars. These discrepancies were also observed in PY2019 and PY2020.

Recommendation 9. Ensure that auditors are installing the Tier-2 smart power bars with audiovisual (AV) equipment, or include installation location in the data collection form. Verify that the correct energy savings values are applied to the correct measure.

Please note that a similar recommendation to Recommendation 10 was included in the PY2019 and PY2020 evaluation. In response to the recommendation in PY2019, the IESO indicated that they would work with the program delivery vendor to ensure that Tier-2 power bars were installed with AV equipment. Given the persistence of the issue across program years, this recommendation is provided again in PY2021 to ensure that it continues to be considered in future program years.

Appendix A Detailed Methodology

This appendix presents the methodology applied for various components of the HAP evaluation: impact, cost-effectiveness, avoided GHG emissions, process, and jobs impacts.

A.1 IMPACT METHODOLOGY

This appendix presents additional details about the impact evaluation methodology. A summary of the methodology was provided in Section 2.1.

A.1.1 Impact Sampling

The NMR team sampled HAP at the project level to generate data for the desk reviews (Table 10). Initially, the projects were examined to determine what measures and combination of measures were most common across projects to ensure that strata could be created without excluding any measure categories. Projects were then binned based on the level of deemed gross savings for the entire project. These bins were the high-savers (projects whose summed measure savings were in the top 20% of savings), medium-savers (projects whose summed measure savings were in-between 33% and 80% of total distributed savings) and low-savers (projects whose summed measure savings were in the lowest 33% of total distributed savings). The NMR team used the projects that resulted in the top 20% of program savings to sample from for the desk review. Initial allocations did not yield enough sample points to obtain the desired confidence levels for some of the critical measures of interest. To address these deficiencies, the NMR team re-ran the allocation, oversampling low-incidence projects with dehumidifiers, thermostats, and window air conditioners. These steps resulted in a final sample size of 227. This approach balanced competing needs, that the desk review sample include the most program savings possible while covering as many low-incidence measures as possible.

Table 10: Desk Review Sample Summary

n	Avg. # of Measures per Project	Avg. kWh Deemed Savings per Project
227	7	5,197

A.1.2 Program Tracking Database Review

The NMR team analyzed the participant database and conducted a cross-cutting assessment to identify the evaluation priorities and to develop a sampling plan. The NMR team assigned priorities based on the following metrics:

- Measures that accounted for the largest share of savings
- Measures that have the most uncertainty around their estimated savings
- The amount of evaluation work done for each measure in previous evaluations

The NMR team also conducted a comprehensive review of the HAP tracking database in order to identify key measures, savings discrepancies, and other issues that impact the accuracy of

reported savings. The review checked for consistency between measures and the Measures and Assumptions List (MAL) values and verified the accuracy of reported savings calculations based on the IESO substantiation sheet algorithms for prescriptive measures that were updated as a part of the PY2019 HAP impact evaluation.[16] The NMR team also leveraged the database to calculate gross and verified net savings for the entire population. Equation 1 shows the program tracking data correction factor calculation, which aligned reported savings with the PY2019 evaluation substantiation sheet savings updates. Note that if there were no errors or inconsistencies in the reported savings calculations, the correction factor would equal one.

Equation 1: Program Tracking Data Correction Factor

$$Tracking\ Data\ Correction\ Factor\ (CF) = Deemed\ savings\ value\ (PY2019\ Updated\ Substantiation\ Sheet\ Savings) \div Reported\ Savings$$

A.1.3 In-Service Rate (ISR) and Hours of Use (HOU) Analysis

As in PY2019 and PY2020, the NMR team surveyed HAP participants to verify the number of measures installed and in use on their premises. The NMR team applied the average of the PY2021 and PY2020 participant survey results to achieve the desired sampling error (10%) at the 90% confidence interval (CI) for surveyed measures.[17] These ISR values were applied to the verified savings calculations for all surveyed measures.

The NMR team also surveyed participants to determine HOU for measures more directly impacted by occupant usage. The PY2021 and PY2020 HOU results were also averaged to develop more robust usage estimates. Unlike the ISR analysis, only select measures received HOU adjustments, detailed below:

Lighting. The NMR team determined that further evaluation would be necessary to consider the self-reported lighting usage values as valid for substituting into substantiation sheets and/or calculating verified lighting savings. The substantiation sheets source values from studies that logged actual lighting usage in residential settings. It should be noted that the self-reported HOU from the PY2021 and PY2020 results were within 2% of the substantiation HOU.

Aerators. The NMR team determined that further evaluation would be necessary to consider the self-reported aerator usage values as valid for substituting into substantiation sheets and/or calculating verified aerator savings. Survey respondents in PY2021 and PY2020 reported aerator HOU more than five times greater than those documented in IESO substantiation sheets.

Block heater timers. The NMR team updated block heater timer HOU based on combined PY2020 and PY2021 survey results after comparing them with the block heater substantiation sheet values, which established HOU based on self-reported survey responses from the PY2017 block heater timer pilot evaluation. Survey respondents reported less usage than the levels

[16] Note that weatherization measures do not have prescribed values in the MAL and the NMR team evaluated savings for these measures on a case-by-case basis during the desk reviews.
[17] The NMR evaluation team and program staff agreed that the application of survey results from PY2021 and PY2020 provided a more robust estimate of ISR and HOU values.

documented in IESO substantiation sheets, including fewer days per year, fewer baseline operating hours (before timer), and more efficient operating hours (after timer).

Dehumidifiers. The NMR team updated two values determining dehumidifier usage – hours per day and days per year – based on combined PY2020 and PY2021 survey results. Survey respondents reported usage greater than the levels documented in IESO substantiation sheets. The alignment in self-reported survey data over two years are appropriate in the absence of metered usage data.

Showerhead. The NMR team updated two values determining showerhead usage – showers per day and minutes per shower – based on combined PY2020 and PY2021 survey results. Survey respondents reported taking fewer showers per day than documented in IESO substantiation sheets but taking more time per shower. Like dehumidifiers, the alignment of self-reported survey data over two years are an appropriate substitute for metered usage data if that is unavailable.

The results for the ISR and HOU aspects of the participant surveys are discussed in Appendix B.3 and Appendix B.4, respectively.

A.1.4 Engineering Desk Reviews

The engineering desk reviews consisted of a review of a sample of 228 projects that the NMR team selected as part of the program tracking database review process. The program delivery vendor provided the NMR team with documentation for the sampled projects. The NMR team conducted a thorough review of the detailed project documents, which consisted of application forms, invoices, appliance shipment confirmation, energy models, photos, and auditor data collection forms.

A.1.4.1 Prescriptive Measures

The NMR team assessed prescriptive measure quantities and measure descriptions based on the documentation provided for the sampled projects. The NMR team conducted additional research to determine the actual nominal energy usage for appliance measures based on existing and new equipment model numbers (when available) to reflect savings estimates more accurately from these measures. The NMR team used the program tracking data review, the PY2019 review of other TRM's, and the desk review to calculate measure-specific RRs, which the NMR team then applied to the population. The NMR team generated measure specific ISR values from participant survey results and then applied them to gross savings calculations. In addition, some measures received HOU adjustments as a result of the participant surveys. Equation 2 shows the gross verified savings calculation for prescriptive measures. Note that if there were no corrections as a result of the program tracking data review nor adjustments made during the PY2019 substantiation sheet savings review (Equation 1), the RR would only reflect any discrepancies found during the desk review (i.e., quantity discrepancies or installed measure inconsistencies).

The inputs for the equation are described below:

- **Gross verified savings:** The evaluated savings after all evaluation activities—outside of net-to-gross—are conducted.

- **Desk review RR:** This is determined based on the project file documentation. For example, some measures have discrepancies in quantities or types and are included in the tracking data but not verified in the project file documentation.
- **Adjusted TRM Correction Factor (CF):** A general evaluation process to ensure the reported savings align with deemed savings values that are defined in the substantiation sheets (outlined in Equation 1).
- **ISR:** measure specific in-service rates are determined from the participant surveys and are applied to savings to account for some measures that are distributed to participants that are not used. For example, 97% of lightbulbs that were distributed by the program are still in use which is then applied to the savings value for the measure.
- **HOU adjustment:** Hours of use adjustments impact the amount of savings for a given measure. The HOU influence the degree of savings that are calculated. This is generally one or two variables within the algorithm defined by the measure's substantiation sheet.
- **Measure quantity:** The number of measures that a participant received. For example, a participant received 20 lightbulbs would have the per-unit savings value multiplied by 20.

Equation 2: Gross Verified Savings – Prescriptive Measures

$$Gross\ Verified\ Savings = Desk\ Review\ RR \times Adjusted\ TRM\ CF \times ISR \times HOU\ adjustment\ X\ Measure\ Quantity$$

A.1.4.1 Weatherization Measures

The NMR team verified weatherization measures – which include installation of insulation in attics, basements, and walls, as well as air sealing – through a review of HOT2000 energy model files, photo verification, and audit documentation. Savings for the weatherization measures are generally calculated from pre- and post-retrofit upgrades with HOT2000 energy modeling software. The NMR team performed a more detailed and comprehensive engineering analysis of the weatherization measures by reviewing the HOT2000 files and recalculating the savings based on the weatherization upgrades outlined in the project documentation. The NMR team compared savings results from the desk review to the reported savings to determine an RR and applied that to the reported savings for the population of weatherization projects. Note that demand savings from weatherization projects are calculated based on an end-use load profile (also referred to as a summer peak demand factor) that was applied to the gross verified kWh savings. Equation 3 shows the gross verified savings calculation for weatherization measures.

Equation 3: Gross Verified Savings – Weatherization Measures

$$Gross\ Verified\ Savings = Reported\ Savings \times Realization\ Rate$$

A.1.5 Net Verified Energy and Demand Savings

The NMR team applied a NTG ratio value of 1.0 to maintain consistency with previous program year evaluations of HAP. This method is also consistent with other low-income, direct installation programs in other jurisdictions. The NTG ratio of 1.0 indicates that participants would not have

installed the energy-efficiency measures without program intervention. Note that due to a NTG ratio of 1.0, the gross verified savings are equivalent to the net first year savings for the program.

A.1.6 True Up Methodology

The NMR team used two primary methods[18] to calculate the gross and net verified savings for the PY2019 and PY2020 true-up projects due to different reported savings values between the program tracking data:

1. Exact savings method: The NMR team applied the exact savings method to measures with prescribed savings values (i.e., non-weatherization measures). This method accounted for different reported savings values between the evaluated project and true-up project data sets, which resulted in different verified savings values when RRs were applied. This method ensured that evaluated savings values aligned between evaluated and true-up projects.
2. RR method: The NMR team applied the evaluated RRs to all weatherization projects and to measures that were not covered in a previous evaluation (i.e., smart thermostats and freezers <12 cubic feet). This method allowed verified savings calculations for the weatherization projects, which have custom savings based on project-specific characteristics.

The implications of applying these two methods essentially create a consistent result when comparing between evaluated projects and the true-up projects for both PY2019 and PY2020. For example, an 11-watt LED A-line light bulb has the same prescribed savings value in both scenarios.

A.2 COST-EFFECTIVENESS METHODOLOGY

This appendix presents additional details about the cost-effectiveness methodology. A summary of the methodology was provided in Section 2.2.

The cost-effectiveness analysis was completed using IESO's *Cost Effectiveness Tool* and in accordance with the IESO *Cost Effectiveness Guide for Energy Efficiency.*[19] The tool was populated with the following key information from the evaluation:

- First year energy and demand savings in kWh and kW, respectively
- Effective Useful Life (EUL)
- End use load profile
- Incremental equipment and installation cost
- Net to gross ratios for energy savings and demand savings
- Savings for natural gas and water

[18] Note this same method was applied to the PY2019 true up projects in the PY2020 HAP impact evaluation.
[19] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20, 2021, https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

- Adjustments in savings over the life of the program

Additionally, the IESO provided the following information for use in the cost-effectiveness calculation:

- Program administrative costs
- Incentive amounts

The IESO Cost Effectiveness Tool provides many outputs and varying levels of granularity. While the NMR team leveraged various outputs to develop findings and recommendations, the key outputs the team selected to directly present in this report are as follows:

- TRC test costs, benefits, and ratio
- PAC test costs, benefits, and ratio
- Levelized delivery cost by kWh and kW

A.3 PROCESS METHODOLOGY

This appendix presents additional details about the process evaluation methodology. A summary of the methodology was provided in Section 2.3. During the process evaluation, the NMR team collected primary data from key program actors, including the IESO program staff, the program delivery vendor staff, participants, auditors, and contractors. (Table 11). The NMR team collected the data using different methods, depending on what was most suitable for a particular respondent group (e.g., web surveys or telephone-based-IDIs). This data, when collected and synthesized, provides a comprehensive understanding of the delivery of the PY2021 program.

The NMR team directly carried out or managed all process evaluation data collection activities and developed all survey instruments, interview guides, and sample files for use in the interviews and surveys. The survey instruments and interview guides were approved by the IESO Evaluation Measurement and Verification (EM&V) staff, and the data used to develop the sample files came from program records supplied either by the IESO EM&V staff or the program delivery vendor.

The NMR team conducted the in-depth telephone interviews with the IESO program staff and the program delivery vendor staff using in-house staff (rather than through a survey lab). The NMR team fielded HAP participant and HAP auditor and contractor surveys as web-based surveys in partnership with the Resource Innovations survey lab based in Toronto. The NMR team designed the survey instruments and developed the sample lists. The Resource Innovations survey lab then programmed and distributed the surveys using Qualtrics survey software. The NMR team worked closely with the Resource Innovations survey lab to test the programming of each survey and to perform quality checks on all data collected.

Table 11: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
HAP IESO Program Staff and Program Delivery Vendor Staff[20]	Phone IDIs	NMR Staff	2	2	0%
HAP Auditors and Contractors[21]	Web	Nexant Survey Lab	31	71	11.3%
HAP Participants	Web	Nexant Survey Lab	319	1,246	4.0%

The following subsections provide additional details about the process evaluation methodology.

A.3.1 IESO Program Staff and Program Delivery Vendor Staff Interviews

The NMR team completed one interview with two IESO program staff member and one interview with three program delivery vendor staff members to gain a detailed understanding of HAP in PY2021 (Table 12). The purpose of the interviews was to better understand program design, delivery, and barriers, and solicit suggestions for improvement.

The interview topics included program roles and responsibilities, program design and delivery, marketing and outreach, market actor engagement, program strengths and weaknesses, and suggestions for improvement.

The NMR team identified the appropriate staff to interview in consultation with the IESO EM&V staff. Each interview took approximately sixty minutes to complete. The NMR team conducted IDIs via phone with the IESO program staff and the program delivery vendor staff from March 24 to April 13 of 2022.

Table 12: HAP IESO Program Staff and Program Delivery Vendor Staff Interview Disposition

Disposition Report	Count
Completes	2
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	-
Screened Out	-
No Response	-
Total Invited to Participate	2

[20] Please note that the interviewed IESO program staff and program delivery vendor staff provided feedback for both HAP and the Energy Affordability Program (EAP). EAP was offered for the first time in PY2021 and will replace HAP in future program years. Given the similarities between HAP and EAP, there is overlap across the IESO program staff and program delivery vendor staff results in PY2021.

[21] Please note that, like the IESO program staff and delivery vendor staff interviews, the surveyed auditors and contractors provided feedback for both HAP and EAP. Given the similarities between HAP and EAP, there is overlap across the auditor and contractor survey results in PY2021.

A.3.2 Auditor and Contractor Survey

The NMR team surveyed 71 HAP auditors and contractors from a sample of 31 auditors and contractors (Table 13). The purpose of the survey was to better understand HAP auditor and contractor perspectives related to program delivery.

The interview topics included role in the program, firmographics, the application process, training and education received, outreach and marketing to customers, measure eligibility criteria, measure-related cost caps, program barriers, satisfaction, suggestions for program improvement, including additional equipment or services to consider impacts of COVID-19, and job impacts. The NMR team developed the survey sample with support from the program delivery vendor, who provided a contact list of 46 auditors and 19 contractors. The NMR team employed a census-based approach to reach the largest number of respondents possible given the small number of unique contacts.

The NMR team delivered the survey over the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. Survey implementation was conducted between March 24 and April 12 of 2022. The survey took an average of 18 minutes to complete after removing outliers.[22] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 13: HAP Auditor and Contractor Survey Disposition

Disposition Report	Count
Completes	31
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	3
Screened Out	1
No Response	36
Total Invited to Participate	71

A.3.3 Participant Survey

The NMR team surveyed 476 HAP participants from a sample of 1,247 unique contacts (Table 14). The purpose of the survey was to better understand HAP participant perspectives related to program experience.

The survey topics included ISRs; HOU; how participants learned about and applied to the program; motivations for doing the upgrades; education and materials provided by the energy auditor; suggested energy-saving methods that participants implemented; satisfaction with various aspects of the program process; suggestions for program improvement, including additional equipment or services to consider; job impacts; and demographics.

The NMR team developed the sample from program records provided by the IESO EM&V staff. Given the large number of program participants, the NMR team randomly selected a subset of participants for inclusion in the survey sample.

The NMR team delivered the survey over the web in partnership with the Resource Innovations survey lab using Qualtrics survey software. The NMR team conducted survey implementation between March 10 and April 5 of 2022. The survey took an average of 13 minutes to complete after removing outliers.[22] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

Table 14: HAP Participant Survey Disposition

Disposition Report	Count
Completes	319
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	43
Screened Out	91
Refused	20
No Response	773
Total Invited to Participate	1,246

A.3.4 Participant Sampling Plan

The NMR team sampled HAP participants using individual projects as the sampling unit. The project-level allocation of sample weighted the data at the measure level to ensure that the results accurately reflected measure categories across projects. Following the PY2019 and PY2020 approaches, NMR initially binned projects by their level of deemed gross savings. These bins included high savers (participants whose summed measure savings were in the top 20% of savings), medium savers (participants whose summed measure savings were in-between 21% and 80% of total distributed savings) and low savers (participants whose summed measure savings were in the lowest 20% of total distributed savings). The NMR team used these savings bins as the sampling strata and refer to them as the high-, medium-, and low-savings strata. Sampling by these strata ensures that participants across the binned savings categories would be proportionately represented in the sample.

The NMR team used Neyman Allocation[23] to optimally sample projects from each of the three strata given the overall number of sample points desired. After initially drawing the sample by the savings strata based on the project-level savings, NMR then examined the selected sample to assess how well they represented the population of measures installed across the projects. Ideally, NMR wanted the sample for each measure to be large enough to include at least 70 completions for each measure. However, this assessment revealed that the initial allocations did not yield enough sample points to obtain the desired confidence levels for HOU and ISR for some of the critical measures of interest. To address these deficiencies, the NMR team re-ran the allocation, oversampling low-incidence projects with aerators, block heaters, showerheads,

[22] Note that the survey was designed to allow the respondent to come back to the survey at a later time to complete it if they preferred. The average survey time was calculated with this in mind and assumed that any survey that took 40 minutes or more to complete was likely completed by a respondent who took a break before completing the survey.
[23] See Chapter 11 of the Uniform Methods Project for examples of Neyman Allocation in evaluation. https://www.nrel.gov/docs/fy17osti/68567.pdf

thermostats, and window air conditioners. Likewise, the NMR team verified that sampled projects provided adequate coverage of the different IESO regions surveyed. Table 15 shows the original sample plan. As seen in Table 14, the survey response was very successful, resulting in 319 survey completes. Table 16 compares the number of program participants in the population that installed each measure category with the number of participants contacted for the survey, and who completed the survey.

Table 15: HAP Participant Sample Plan Summary

Project Strata	Project Count	Measure Count	90% Error Margin
Top 20% of Savings	54	13,758	10.8%
Mid 47% of Savings	566	6,734	2.8%
Bottom 33% of Savings	582	1,688	2.1%

Table 16: HAP Participant Survey Project Counts and Completes by Measure Category

Measure Category	Projects in Population	Invited to Participate	Completed Survey
Lighting	1,629	1,043	235
Dehumidifiers	169	132	33
Freezers	375	286	83
Refrigerators	818	590	167
Window Air Conditioners	40	27	7
Weatherization – Building Shell	660	153	53
Smart Power Bars	1,290	889	202
Aerators	270	181	22
Showerheads	222	167	28
Pipe / Tank Wrap	157	117	62
Block Heater Timers	334	270	20
Indoor Clothes Drying Racks	1,173	924	198
Thermostats	607	239	77

A.4 JOBS IMPACT METHODOLOGY

This appendix presents additional details about the job impact methodology. A summary of the methodology was provided in Section 2.4.

The analysis of job impacts utilized the StatCan IO model to estimate direct and indirect job impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. A system of linear equations represents how certain industries' outputs become the inputs for other industries, while other outputs become consumer goods. When an energy-efficiency program such as HAP is funded and implemented it creates a set of "shocks" to the economy, such as demand for specific products and services, and additional household expenditures from energy bill savings. The shocks propagate throughout the economy and their impacts can be measured in terms of variables such as economic output and employment.

A.4.1 Statistics Canada IO Model

The Industry Accounts Division of StatCan maintains two versions of a Canadian IO model: a national, and an interprovincial model[24]. The models are classical Leontief-type open-IO models[25], where some production is consumed internally by industries, while the rest is consumed externally. The models provide detailed information on the impact of exogenous demands for industry outputs. The impacts are quantified in terms of production, value-added components (such as wages and surplus), expenditures, imports, employment, energy use, and pollutant emissions by industry. The StatCan IO Model is composed of input, output, and final demand tables. IO tables are published annually with a lag of approximately three years, so the model used for this analysis represents the Canadian economy from 2018. The model has been used to model employment impacts from a wide range of economic shocks, including structural changes to the Canadian economy[26], the bovine spongiform encephalitis (BSE) crisis in the early-mid 2000's[27], and the construction of hydropower projects[28].

The supply and use tables (SUTs) for the Canadian IO model break the economy down into 240 industries and 500 SUPCs. They represent the economic activity of a specific Canadian province, or of the whole country. The SUTs show the structure of the Canadian economy, with goods and services flowing from production or import (supply tables) to intermediate consumption or final use (use tables). Intermediate consumption refers to domestic industries using goods and services to produce other products and services. Final use includes consumption of products by households, non-profit institutions serving households, and governments; capital formation; changes in inventory; and exports. Provincial SUTs are similar to national SUTs, but for the addition of interprovincial trade to go along with the international imports and exports.

StatCan offers the IO Model as a service but not as a product. StatCan economists work with researchers to develop the data and inputs to develop and answer specific research questions using the model. The end product is a set of outputs from running the model.

A.4.2 Approach

The process for using the StatCan IO model followed three steps:

1. Developed specific set of research questions to address with the IO model, reflecting the exogenous shocks caused by the program.
2. Developed model inputs, which consisted of exogenous shock values (in dollars) to simulate the effects of HAP.
3. Ran the model and interpreted the results.

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[24] Statistics Canada - Industry Accounts Division System of National Accounts; (2009). User's Guide to the Canadian Input-Output Model. Statistics Canada. Ret
[25] Ghanem, Ziad; (2010). The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework. Statistics Canada – Industry Accounts Division.
[26] Gera, S & Masse, P; (1996). Employment Performance in the Knowledge-Based Economy, Gouvernement du Canada - Industrial Organization 14, Gouvernement du Canada - Industry Canada.
[27] Samarajeewa, S. et al.; (2006). Impacts of BSE Crisis on the Canadian Economy: An Input-Output Analysis. Prepared for the Annual Meeting of the Canadian Agricultural Economics Society.
[28] Desrochers, R. et al.; (2011). Job Creation and Economic Development Opportunities in the Canadian Hydropower Market. Canadian Hydropower Association.

The following sections cover each step in more detail.

A.4.2.1 Developed Specific Research Questions

The first step in modeling the job impacts from HAP was to determine which specific research questions (RQs) the model would answer. In a scenario without the existence of HAP, customers receive electricity from IESO and pay for it via the monthly billing process. Delivering HAP introduces a set of economic supply and demand shocks to different sectors of the economy. The four research questions below illustrate these shocks:

1. **What are the job impacts from new demand for energy-efficient measures and related program delivery services?** Funds collected for HAP generate a demand for efficient equipment and appliances. They also generate a demand for services related to program delivery, such as audits at customer premises, call center operations, and general overhead for program implementation and staffing. This demand creates jobs among firms that supply these products and services.
2. **What are the job impacts from household energy bill savings?** Once energy-efficient equipment is installed in households, the customers realize annual energy savings for the useful life of the measures. Households can choose to put this money into savings or to spend it on goods and services in the economy. This additional money and the decision to save or spend has implications for additional job creation. For instance, additional household spending on goods and services generates demand that can create jobs in other sectors of the economy.
3. **What are the job impacts from funding the energy-efficiency program?** IESO energy-efficiency programs are funded via volumetric bill charges for all customers – both residential and non-residential. This additional charge can reduce the money that households have for savings and for spending on other goods and services. It also impacts non-residential customers. This additional bill charge results in a negative impact on jobs in the Canadian economy.
4. **What are the job impacts from reduced electricity production?** The energy-efficient measures will allow households to receive the same benefit while using less electricity. The program as a whole will reduce the demand for electricity in the residential sector. This reduced demand could have upstream impacts on the utility industry (e.g., generation) and related industries, such as companies in the generator fuel supply chain.

A.4.3 Developed Model Inputs

The second step in modeling job impacts was to gather the data required for the StatCan IO model to answer each of the research questions. Model input data included the dollar values of the exogenous shocks from program delivery. The sources of data for each research question were as follows:

1. **Demand for energy-efficient measures and related program delivery services.** The StatCan IO Model divides the Canadian economy into 240 industry classifications and 500 SUPCs. Each measure installed as part of the program was classified into one of the

SUPCs. The dollar value for each product-related demand shock was calculated using the measure cost and quantity data from the impact evaluation (see Section 2.4).

Services that were part of the delivery process were also classified into SUPCs. The vast majority of these services were either audits or program administrative services. Customer audits had flat fees for calculating the value of the demand shock and the value of administrative services was obtained from program budget actuals.

It was necessary to specify the amount of each demand shock attributed to labor versus non-labor. For the product categories, we used the labor versus non-labor cost estimate proportions from the measure research conducted as part of the cost-effectiveness analysis. For the service categories, the IO model contained underlying estimates that defined the portion of labor versus overhead (non-labor).

2. **Household energy bill savings.** This value was calculated for the model as the net present value (NPV) of the discounted future stream of energy bill savings by participants. It was calculated by multiplying net energy savings[29] (in kWh) in each future year by that future year's retail rate ($/kWh). This calculation was performed for each future year through the end of the measure's EUL. Savings beyond the EUL were assumed to be zero. Measure-level energy saving estimates were obtained from the impact evaluation. The other calculation parameters (discount rate, measure EULs, and retail rate forecast) align with the cost-effectiveness analysis.

   Customers' intentions for whether to spend or save the money saved on energy bills was obtained via a short section on the customer surveys. The percentages that indicated what the customers would do with the bill savings were obtained from the participant surveys through the following two questions:

   J1. What do you anticipate you will do with the money saved on electricity bills from the energy-efficient equipment upgrades?

   1. Pay down debt or put the money into savings
   2. Purchase more goods and/or services
   3. Split – put some money into savings/debt payments and use some money to purchase more goods/services
   4. Other. Please specify.
   98. Don't know
   99. I'd rather not answer

   [BASE: IF RESPONDENT WILL SPLIT MONEY SAVED IN VARIOUS WAYS (J1=3)]

   J2. Approximately what would be the split between savings/debt payments and purchasing more goods/services? [ALLOW MULTIPLE RESPONSE OPTION]

[29] The net-to-gross ratio for HAP is 1, so the net energy savings are the same as gross savings.

1. *Percent saved or used to pay down debt [NUMERIC RESPONSE BETWEEN 0 and 100]*
2. *Percent used to purchase more goods and services [NUMERIC RESPONSE BETWEEN 0 and 100]*
98. *Don't know*
99. *I'd rather not say*

For estimating job impacts, the key input value was the amount of bill savings that customers would spend—as opposed to save.

3. **HAP funding.** IESO energy-efficiency programs are funded by a volumetric charge on electricity bills and, volumetrically, residential customers accounted for 35 percent of consumption and non-residential customers accounted for 65 percent in 2019[30]. The overall program budget was distributed between these two customer classes by these percentages.
4. **Reduced electricity production.** The NPV of retail savings (estimated as part of RQ2) was also the input for examining a potential impact of producing less electricity.

A.4.3.1 Run Model and Interpret Results

Determining the total job impacts from HAP required considering possible impacts from each the four shocks represented by the research questions. Addressing the four research questions above required only two runs of the StatCan IO model, as certain components of the shocks could be consolidated, and others addressed without full runs of the model. The two shocks that were modeled were as follows:

1. Demand shock as outlined in RQ1, representing the impact of the demand for energy-efficient products and services due to HAP.

2. Household expenditure shock representing the net amount of additional spending that the residential sector will undertake. This was estimated by taking the NPV of energy bill savings and subtracting the residential contribution to program funding. Thus, the model run combined RQ2 with the residential component of RQ3.

The model output generated three types of job impact estimates: direct, indirect, and induced impacts – as described in Section 2.4.

[30] Annual Planning Outlook – A view of Ontario's electricity system needs; 2020. IESO.

Appendix B Additional Impact Evaluation Results

This appendix presents additional results associated with the impact evaluation activities. Higher-level results were provided in Section 3.

B.1 Detailed Impact Results

Table 17 presents the detailed measure-level results of the impact evaluation for projects completed in PY2021. The savings and quantities in the table represent the measure-level savings. The proportion of total program savings is included to show the representative impact of each measure's energy and demand savings on HAP. The savings values in the table represent the measure-level savings for the entire population.

Table 17: Aggregate Measure-Level Energy and Demand Savings

Measure	Quantity Installed	Reported Savings – Energy (kWh)	Reported Savings – Demand (kW)	RR – Energy	RR – Demand	Verified Savings – Energy (kWh)	Verified Savings – Demand (kW)	Percent of Program Savings – Energy (kWh)	Percent of Program Savings – Demand (kW)
Lighting end-use									
=11W ENERGY STAR® Qualified LED A Shape (60W) (minimum 600 Lumen output) (Formerly: 7W – 11W ENERGY	15,510	739,827	46.5	75%	80%	554,381	37.1	18.2%	16.4%
=11W ENERGY STAR® Qualified LED MR 16 (minimum 400 Lumen output) (Formerly: 7W – 12W ENERGY STAR® Qu	333	11,888	0.7	86%	103%	10,195	0.7	0.3%	0.3%
=14W ENERGY STAR® Qualified LED A Shape (75W) (minimum 800 Lumen output) (Formerly:10W – 14W ENERGY	247	11,708	0.7	74%	78%	8,650	0.6	0.3%	0.3%
=16W ENERGY STAR® Qualified LED PAR 20 (minimum 600 Lumen output) (Formerly: 8W – 12W ENERGY STAR® Q	522	23,960	1.6	90%	92%	21,526	1.4	0.7%	0.6%
=16W ENERGY STAR® Qualified LED PAR30 & PAR38 (minimum 600 Lumen output) (Formerly: 8W – 12W ENERGY	317	17,879	1.3	118%	112%	21,130	1.4	0.7%	0.6%

Measure	Quantity Installed	Reported Savings – Energy (kWh)	Reported Savings – Demand (kW)	RR – Energy	RR – Demand	Verified Savings – Energy (kWh)	Verified Savings – Demand (kW)	Percent of Program Savings – Energy (kWh)	Percent of Program Savings – Demand (kW)
=23W ENERGY STAR® Qualified LED A Shape (100W) (minimum 1600 Lumen output) (Formerly: 17W – 23W ENER	1,032	63,262	4.1	96%	99%	60,842	4.1	2.0%	1.8%
=23W ENERGY STAR® Qualified LED PAR (minimum 1100 Lumen output) (Formerly: 14W – 18W ENERGY STAR® Qu	306	16,157	1.2	86%	76%	13,834	0.9	0.5%	0.4%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16 (minimum 250 Lumen output) (Formerly:7W – 10W ENERGY S	994	37,474	3.0	99%	84%	37,169	2.5	1.2%	1.1%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt (minimum 1100 Lumen output)	220	11,704	0.9	86%	76%	10,031	0.7	0.3%	0.3%
Lighting Total	**19,481**	**933,858**	**60.0**	**79%**	**82%**	**737,760**	**49.4**	**24.2%**	**21.8%**
Appliances									
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 – 21.2 l/day)	165	40,062	12.9	140%	138%	56,064	17.8	1.8%	7.8%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 – 25.4 l/day)	11	2,184	0.7	174%	173%	3,804	1.2	0.1%	0.5%

Measure	Quantity Installed	Reported Savings – Energy (kWh)	Reported Savings – Demand (kW)	RR – Energy	RR – Demand	Verified Savings – Energy (kWh)	Verified Savings – Demand (kW)	Percent of Program Savings – Energy (kWh)	Percent of Program Savings – Demand (kW)
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 – 35.5 l/day)	1	183	0.1	152%	152%	279	0.1	0.0%	0.0%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	222	23,288	3.1	256%	260%	59,541	8.1	2.0%	3.6%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	160	16,480	2.2	180%	180%	29,711	4.0	1.0%	1.8%
Freezer Replacement (ENERGY STAR Qualified 7-12.0 cu ft)	25	1,375	0.2	230%	246%	3,164	0.4	0.1%	0.2%
Refrigerator Replacement (10.0 – 12.5 cu ft)	184	33,120	4.4	100%	98%	33,018	4.3	1.1%	1.9%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	154	31,570	4.2	130%	130%	40,991	5.4	1.3%	2.4%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	485	105,730	14.1	116%	115%	122,637	16.1	4.0%	7.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	6	452	0.5	45%	45%	202	0.2	0.0%	0.1%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	12	492	0.6	219%	217%	1,079	1.3	0.0%	0.6%

Measure	Quantity Installed	Reported Savings – Energy (kWh)	Reported Savings – Demand (kW)	RR – Energy	RR – Demand	Verified Savings – Energy (kWh)	Verified Savings – Demand (kW)	Percent of Program Savings – Energy (kWh)	Percent of Program Savings – Demand (kW)
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	26	1,508	1.8	83%	83%	1,254	1.5	0.0%	0.7%
Appliance Total	**1,451**	**256,444**	**44.7**	**137%**	**135%**	**351,743**	**60.5**	**11.5%**	**26.6%**
Domestic Hot Water (DHW)									
Efficient Aerators (bathroom) < 3.8 Liters Per Minute (Lpm)	130	6,396	0.7	66%	79%	4,201	0.5	0.1%	0.2%
Efficient Aerators (kitchen) < 5.7 Lpm	133	16,692	1.6	98%	100%	16,347	1.6	0.5%	0.7%
Efficient Showerhead (handheld) < 4.8 Lpm	94	21,968	2.2	73%	72%	16,062	1.6	0.5%	0.7%
Efficient Showerheads (standard) < 4.8 Lpm	63	14,723	1.4	105%	104%	15,515	1.5	0.5%	0.7%
Hot Water Tank Insulation – Fiberglass R10	10	992	0.1	92%	100%	912	0.1	0.0%	0.0%
Hot Water Tank Pipe Insulation - ½" (per foot)	372	17,893	1.9	14%	14%	2,556	0.3	0.1%	0.1%
Hot Water Tank Pipe Insulation - ¾ " (per foot)	38	2,732	0.3	22%	22%	609	0.1	0.0%	0.0%
DHW Total	**840**	**81,396**	**8.1**	**69%**	**69%**	**56,202**	**5.6**	**1.8%**	**2.5%**
Building Shell									
Attic Insulation	268,473	268,473	3.8	114%	413%	305,087	15.5	10.0%	6.8%
Basement insulation	258,382	258,382	3.6	112%	414%	288,574	15.0	9.5%	6.6%
Comprehensive Draftproofing	206,829	206,829	2.5	127%	481%	263,618	12.0	8.7%	5.3%

Measure	Quantity Installed	Reported Savings – Energy (kWh)	Reported Savings – Demand (kW)	RR – Energy	RR – Demand	Verified Savings – Energy (kWh)	Verified Savings – Demand (kW)	Percent of Program Savings – Energy (kWh)	Percent of Program Savings – Demand (kW)
Wall Insulation	75,315	75,315	1.1	128%	413%	96,063	4.4	3.2%	1.9%
Building Shell Total	**808,999**	**808,999**	**10.9**	**118%**	**429%**	**953,342**	**46.8**	**31.3%**	**20.6%**
Power Bars									
Smart Power Bar	1,032	3,715	0.0	5,983%	0%	222,286	7.0	7.3%	3.1%
Power Bar Total	**1,032**	**3,715**	**0.0**	**5,983%**	**N/A**	**222,286**	**7.0**	**7.3%**	**3.1%**
Miscellaneous									
Block Heater Timer (just timer)	221	52,841	0.0	19%	0%	9,869	0.0	0.3%	0.0%
Indoor Clothes Drying Rack	859	83,323	55.8	87%	87%	72,580	48.6	2.4%	21.4%
Programmable Thermostat – Line Voltage	462	56,456	0.0	162%	0%	91,564	0.0	3.0%	0.0%
Programmable Thermostat – Low Voltage	202	266,923	0.0	99%	0%	263,192	0.0	8.6%	0.0%
Smart Thermostat – Line Voltage (connected unit)	1,099	204,689	0.0	96%	0%	195,560	0.0	6.4%	0.0%
Smart Thermostat – Line Voltage (controller unit)	338	62,953	0.0	99%	0%	62,073	0.0	2.0%	0.0%
Smart Thermostat – Low Voltage	19	15,936	4.8	99%	99%	15,713	4.7	0.5%	2.1%
Smart Thermostat – Low Voltage (with C-wire)	18	15,097	4.5	99%	99%	14,886	4.4	0.5%	2.0%
Miscellaneous Total	**3,218**	**758,218**	**65**	**96%**	**89%**	**725,436**	**57.7**	**23.8%**	**25.4%**
Program Total	**835,021**	**2,842,629**	**189**	**107%**	**120%**	**3,046,770**	**227**	**100%**	**100%**

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B.1.1 Lighting

The NMR team verified the savings for lighting measures using the project file data and lighting specific information collected by the HAP auditors. There are various light bulb products that are offered by the program for direct installation based on the replaced bulb type. The overall energy RR for lighting measures was 79%. In addition, the NMR team applied the combined PY2021 and PY2020 ISR results from the participant survey to the gross verified savings.

The lighting end-use category is dominated by A-line type bulbs. The 11-watt A-line bulb contributes to 18.2% of the program savings, while the 23-watt A-line bulb contributes 2% of program savings. A-line bulbs are very common bulb shapes in residential settings, often used in both hard-wired and plug-in fixtures. In addition, A-line bulbs are easily swapped out, whereas other bulb shapes are common in certain fixture types that may not be common in the HAP participant home (i.e., candelabra shaped bulbs in a chandelier-type fixture or a reflector shaped installed into a recessed fixture). The RR for lighting demand savings was 82% due to adjustments from the PY2019 substantiation sheet review and application of the ISR.

B.1.2 Appliances

The NMR team verified the savings for appliances using the project file data and equipment-specific information collected by HAP auditors. The NMR team applied model number lookups to incorporate project-specific values into the desk reviewed savings calculations – instead of default reported savings input assumptions – for the installed equipment and, where possible, the existing equipment. This model-specific data typically included the size or capacity of the equipment and its annual energy consumption. During the desk reviews, the NMR team found that 21% of the appliances, including 66% of dehumidifiers were not the same size as their replacement. In these cases, the appliance was aligned with the corresponding size category to calculate the proportion of energy savings that are associated with replace on failure (i.e., associated with the verified baseline size rather than the existing equipment's). For example, if an 18 cubic foot refrigerator replaced one that was 15 cubic feet, the baseline energy usage would be calculated using the 15 cubic foot (existing) energy consumption for a portion of the equipment life (typically represents one third of the savings) and using the 18 cubic foot (replace on failure baseline) energy consumption to determine the remaining two-thirds of energy savings.

RRs for energy savings were generally high among appliances (137%), particularly with freezers. Appliances accounted for 11.5% of total program gross verified energy savings. The demand RRs (135%) were slightly lower than the energy RRs for appliances but accounted for 26.6% of the program gross verified demand savings.

Refrigerators. The NMR team calculated verified savings based on project-specific annual energy consumption derived from model number lookups for the installed refrigerators and the existing equipment, while the reported savings used the minimum requirements for meeting the ENERGY STAR efficiency specifications. The application of actual annual energy consumption values provides a more accurate savings estimate that does not rely solely on using the minimum ENERGY STAR specifications.

Refrigerators accounted for 196,646 kWh in energy savings (115% RR) and 25.9 kW in demand savings (114% RR). The RR is a result of replacing existing refrigerators that were slightly more

efficient than the baseline default savings value and replacing refrigerators that were in some cases, different sizes than the new appliance.

Freezers. The NMR team calculated verified savings for freezers in a similar way to refrigerators, leveraging model numbers to look up annual energy consumption and comparing it against the ENERGY STAR minimum values used in deemed savings.

Freezers accounted for 92,416 kWh in energy savings (225% RR) and 12.6 kW in demand savings (227% RR). The high RRs for freezers seem to be partially due to the fact that the specific models offered by the program are on the low end of the size categories that freezers are grouped into, and therefore have lower energy consumption than the midpoint of each category, which is used to calculate the prescribed savings. Some freezers were replaced with new freezers that were not in the same size category as the existing appliance. In addition, the model number look up for specific annual energy consumption of existing appliances attributed to the high RR.

Dehumidifiers. Typically, the NMR team limited the data used to verify savings for dehumidifiers to the specific capacity of the equipment (liters per day). The efficiency of the dehumidifiers offered by the program was consistent with the minimum ENERGY STAR specifications, so verified savings were relatively consistent with deemed savings. However, the NMR team adjusted the HOU for dehumidifiers based on the combined responses from the PY2021 and PY2020 participant surveys. Participants indicated that they were using dehumidifiers more frequently and for a longer duration than deemed savings values suggested. Dehumidifiers accounted for 60,147 kWh in gross verified savings (142% RR) and 19.1 kW in gross verified demand savings (140% RR).

Window Air Conditioners. Like other appliances, the NMR team calculated verified savings for window air conditioners by looking up the capacity and efficiency of the installed equipment. These metrics were relatively consistent with the ENERGY STAR minimum specifications used in deemed savings. Window air conditioners accounted for a minimal amount of program savings, with only 2,535 kWh (103% RR) in gross verified energy savings and 3 kW in gross verified demand savings (103% RR).

B.1.3 Weatherization – Building Shell

There were 220 weatherization projects completed in PY2021. The NMR team calculated verified savings with the HOT2000 energy modeling tool that is used by HAP auditors to input the shell details of the participant building. Shell upgrades are only offered to participants with electric heat. HAP auditors create two models of the home: (1) an initial model that represents the existing conditions of the home observed during the initial audit and (2) the final model that includes the values from air sealing and insulation improvements as a result of the program. The tool compares the modeled energy usage of the initial and final energy models, which the NMR team replicated to verify savings.

Weatherization measures accounted for 953,342 kWh of gross verified energy savings (RR of 118%) and 46.8 kW in gross verified demand savings (RR of 429%). Weatherization demand savings are a function of the energy savings and are calculated based on an end-use load profile

(also referred to a summer peak demand factor).[31] The high RRs are a function of reported savings applying a different summer peak demand factor or assumed demand savings value.

The RR for weatherization measures was 118%. This represents a slight decrease from the PY2020 HAP evaluation (120%). In addition, the gross verified savings decreased from 1,020 megawatt-hours (MWh) in PY2020 to 953 MWh in PY2021. There were 220 weatherization projects completed in PY2021 compared to 278 in PY2020. This represents an increase in the savings per participant that received weatherization upgrades and highlights that a continued effort to increase the size, scale, and frequency of weatherization projects administered by future iterations of HAP will provide long-term savings opportunities beyond lighting measures.

B.1.4 Smart Power Bars

The smart power bar includes a sophisticated infrared or occupancy sensor that shuts off the equipment based on occupant behavior. Smart power bars accounted for 222,286 kWh (RR of 5,983%). The high RR for the smart power bar is due to the reported savings for smart power bars applying the power bar with timer measure savings value, a legacy measure that is no longer delivered by HAP in PY2021. The NMR team also observed this reported savings value in the PY2019 and PY2020 HAP impact evaluations. In addition, the NMR team updated the smart power bar savings values as a part of the PY2019 TRM review.

There were no reported demand savings for smart power bars (1,032 units) in the tracking data. Due to this issue in the tracking data, the NMR team could not calculate a gross verified demand RR. The NMR team accounted for demand savings for smart power bars in the verification process, amounting to 7 kW, representing 3.1% of the program's gross verified demand savings.

B.1.5 Domestic Hot Water (DHW)

Domestic hot water (DHW) measures are only offered to participants with electric water heating systems. The NMR team primarily verified savings for water heating measures by confirming the water heater fuel-type and that the measure types and quantities in the project files matched the program tracking data.

DHW measures accounted for 56,202 kWh of gross verified energy savings (RR of 69%) and the gross verified demand savings were 5.6 kW (RR of 69%). The NMR team updated the deemed savings values for pipe wrap, aerators, and showerheads during the PY2019 TRM review. The lower RRs for pipe wrap measures were due to reported savings calculations referencing the total linear feet of insulation installed, which is standard data collection practice by auditors in the field, while the input assumption for reported savings values is in three feet increments. This resulted in an overestimation of reported savings by a multiple of three. While these were drivers to lower

[31] As documented in the EAP evaluation plan, the NMR team and the IESO determined that demand savings from weatherization projects will need to be calculated and verified as the energy modeling software HOT2000 does not provide demand savings and the program tracking data does not consistently include demand savings. The verified demand savings are based on an end-use load profile that was recommended by IESO staff and reviewed by the NMR team.

RRs for this end-use category, DHW measures only represented 1.8% of gross verified energy savings and 2.5% of gross verified demand savings.

B.1.6 Miscellaneous Measures

The NMR team verified savings for the miscellaneous measure category by confirming the measure type and the quantity installed matched between the project files and the program tracking data, as well as through the PY2019 TRM reviews. During the desk review, the NMR team determined that the correct heating system was applied for line (electric baseboards) and low (electric furnaces) thermostats. In addition, the NMR team adjusted the savings associated with homes that did not have permanent cooling to reflect only savings from the heating system. Programmable and smart thermostats were only offered to participants with electric heat.

Miscellaneous measures accounted for 725,436 kWh of gross verified energy savings (RR of 96%) and the gross verified demand savings were 57.7 kW (RR of 89%). Most measures in this end-use category do not claim demand savings, with the exception of indoor clothes drying racks and low voltage smart thermostats. The RR for drying racks reflects the PY2019 TRM reviews. As noted above, during the desk review, the NMR team removed the savings associated with cooling for homes without permanent cooling as they were not applicable. This also impacted demand savings for this measure as demand savings occur during the summer months.

B.2 True-Up Projects

As part of the PY2021 evaluation, the NMR team conducted a true-up for PY2019 and PY2020 projects that had not officially been reported before the PY2020 evaluation occurred but were installed and completed in PY2019 or PY2020.[32] The NMR team calculated the gross and net verified savings for the PY2019 true-up projects based on the evaluated PY2019 RRs. The PY2020 true-up projects are based on the evaluated PY2020 RRs. The NMR team applied the measure-level RRs or the exact savings values to the PY2019 and PY2020 true-up gross savings values. Additional details on the methods used to calculate the true ups are provided in Appendix A.1.6.

The results from the PY2019 and PY2020 true-up projects are presented in . There was a total of 320 PY2019 true-up projects that were included in the PY2021 evaluation. For PY2020 true-ups, there were 1,182 additional projects. The results have been aggregated with the evaluated PY2019 projects in and PY2020 projects in .

[32] Note that any remaining unevaluated HAP projects that are completed will be accounted for in PY2022. Any of these additional projects that are evaluated in PY2022 will add to the total savings impacts of HAP during the Interim Framework (i.e., PY2019, PY2020, and PY2021).

Table 18: PY2019 and PY2020 True-Up Project Results (PY2021 Evaluation)

Program Metric	Energy (MWh)	Demand (MW)
PY2019 True-Up Reported	33	0.004
PY2019 True-Up Gross Verified Savings	35	0.005
RR	105%	104%
PY2020 True-Up Reported	237	0.04
PY2020 True-Up Gross Verified Savings	278	0.05
RR	117%	117%

Table 19: HAP PY2019 Evaluated and PY2019 True-Up Aggregated Results

Metric	Units	PY2019 Evaluated	True Ups (PY2020 evaluation)	True Ups (PY2021 evaluation)	Aggregated PY2019 results
Participation	Projects	9,988	743	320	11,051
Participation	Homes	9,968	738	320	11,026
Reported Savings	MWh	10,067	1,119	33	11,220
Reported Savings	MW	4.20	0.12	0.004	4.33
Gross RR	MWh	0.86	0.97	1.05	0.87
Gross RR	MW	0.22	0.93	1.04	0.24
Gross Verified Savings	MWh	8,647	1,088	35	9,770
Gross Verified Savings	MW	0.91	0.11	0.005	1.02
NTG	--	1.00	1.00	1.00	1.00
Net Verified Annual Savings (First Year)	MWh	8,647	1,088	35	9,770
Net Verified Annual Savings (First Year)	MW	0.91	0.11	0.005	1.02
Net Verified Annual Savings (PY2022)	MWh	8,647	1,088	35	9,770
Net Verified Annual Savings (PY2022)	MW	0.91	0.11	0.005	1.02

Table 20: HAP PY2020 Evaluated and PY2020 True-Up Aggregated Results

Metric	Units	PY2020 Evaluated	True Ups (PY2021 evaluation)	Aggregated PY2020 results
Participation	Projects	11,440	1,182	12,622
Participation	Homes	11,402	1,182	12,584
Reported Savings	MWh	12,117	237	12,353
Reported Savings	MW	1.24	0.04	1.28
Gross RR	MWh	0.97	1.17	0.97
Gross RR	MW	0.94	1.17	0.94
Gross Verified Savings	MWh	11,765	278	12,043
Gross Verified Savings	MW	1.16	0.05	1.20
NTG	--	1.00	1.00	1.00
Net Verified Annual Savings (First Year)	MWh	11,765	278	12,043
Net Verified Annual Savings (First Year)	MW	1.16	0.05	1.20
Net Verified Annual Savings (PY2022)	MWh	11,765	278	12,043
Net Verified Annual Savings (PY2022)	MW	1.16	0.05	1.20

B.3 IN-SERVICE RATES

Figure 14 displays the energy-efficiency upgrades respondents confirmed receiving. The majority of respondents (74%) received LEDs; on average, respondents received 21 LEDs. Additionally, many respondents received a power bar (63%) and/or a drying rack (62%). Over one-half (52%) of respondents received a refrigerator.

Figure 14: Energy-Efficiency Upgrades that Program Participants Received (n=319)

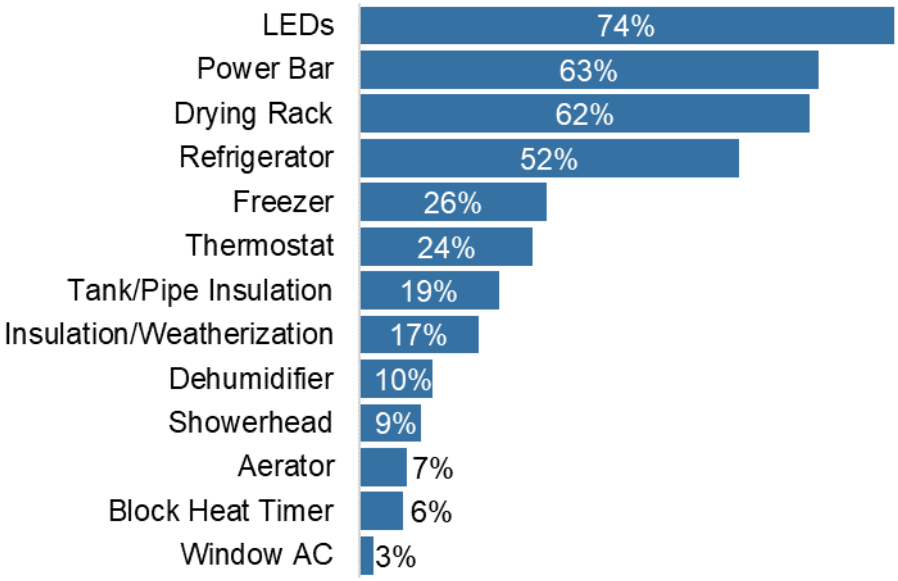


Figure 15 displays the ISRs for respondents' upgrades. All the freezers and dehumidifiers respondents received were still installed and functional at the time of the survey. Nearly all the refrigerators (99%), thermostats (99%), and LEDs (96%) were still installed and functional. The upgrades with the lowest ISRs were showerheads (77%) and block heater timers (75%).

Figure 15: Energy-Efficiency Upgrade ISRs

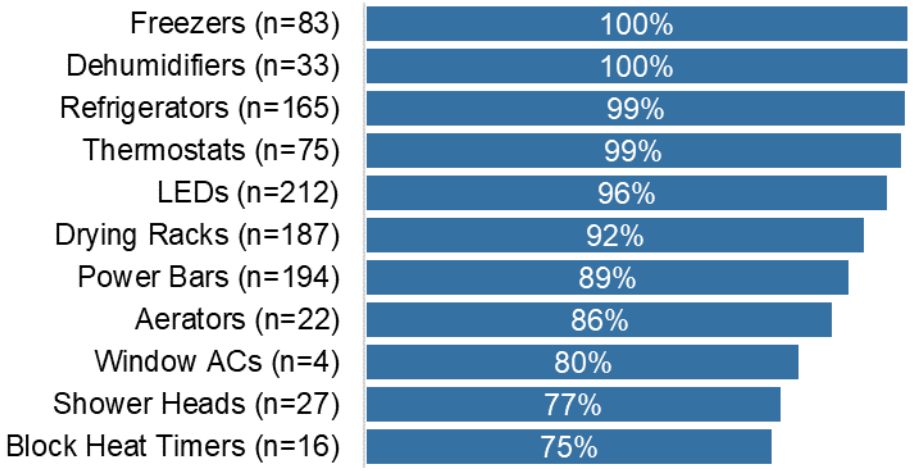


Figure 16 compares the PY2020 and PY2021 ISRs. The PY2021 ISRs are within three percentage points of the PY2020 ISRs for most measures. The exceptions are aerators, window ACs, showerheads, and block heater timers, for which the ISRs decreased by six to fourteen percentage points between PY2020 and PY2021. However, it should be noted that the 2021 sample sizes for these measures were significantly smaller than the 2020 sample sizes.

Figure 16: Comparison of PY2020 and PY2021 ISRs

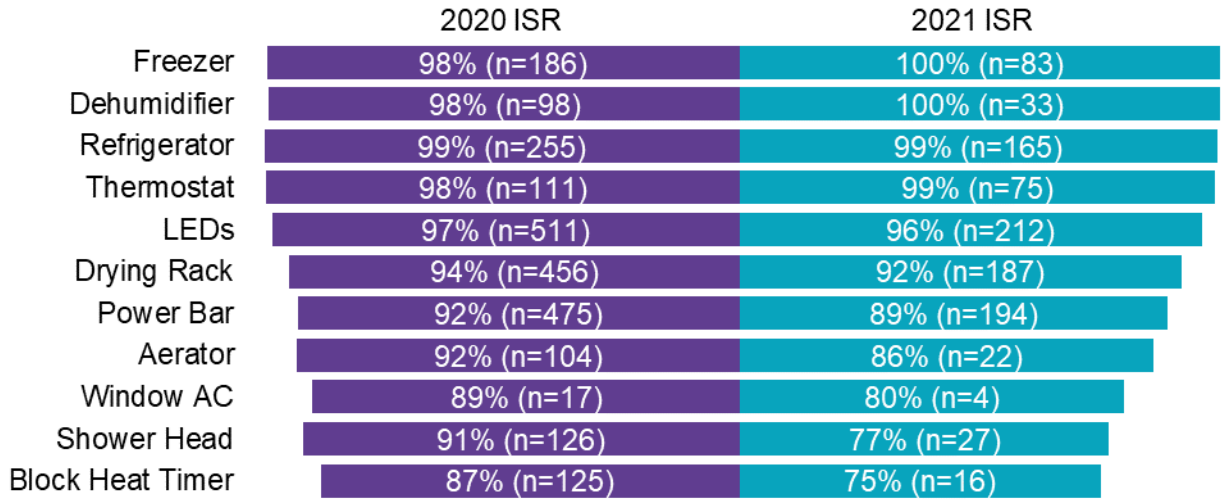
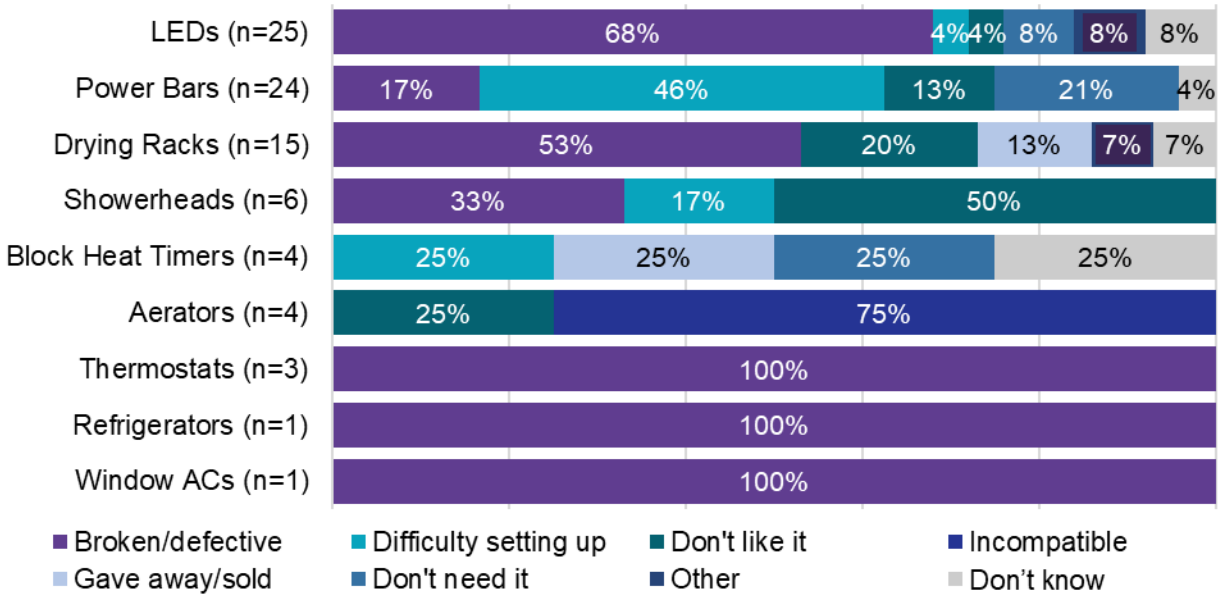


Figure 17 displays the reasons respondents gave for uninstalling or removing upgrades. The most common reason for uninstalling or removing LEDs (68%), drying racks (53%), thermostats (100%), refrigerators (100%), and window ACs (100%) was that they were broken or defective. Nearly one-half (46%) of respondents who uninstalled or removed power bars had difficulty setting them up. One-half of respondents who uninstalled or removed showerheads (50%) simply did not like them.

Figure 17: Reasons Respondents Uninstalled or Removed Upgrades



B.4 HOURS OF USE

The participant survey collected HOU information for several upgrades that homeowners received through the program in PY2021.

Figure 18 and Figure 19 display the average number of program-provided LEDs installed by room type and the average hours per day respondents used their LEDs.

The highest number of LEDs installed occurred in basements (average of 4.5 bulbs) and the highest hours per day of use occurred in living rooms and kitchens (average of 4.3 hours).

Figure 18: Number of LEDs Installed by Room Type

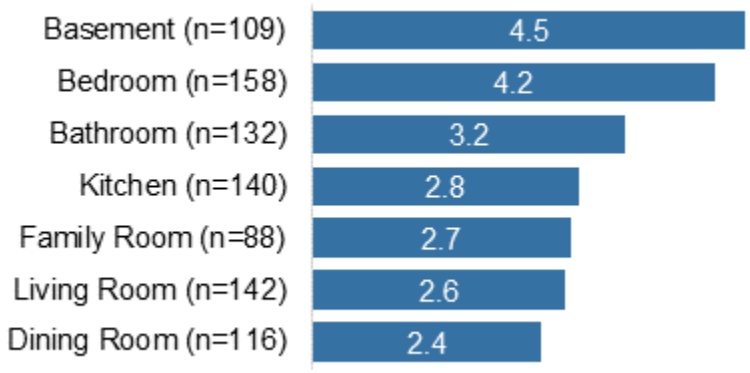
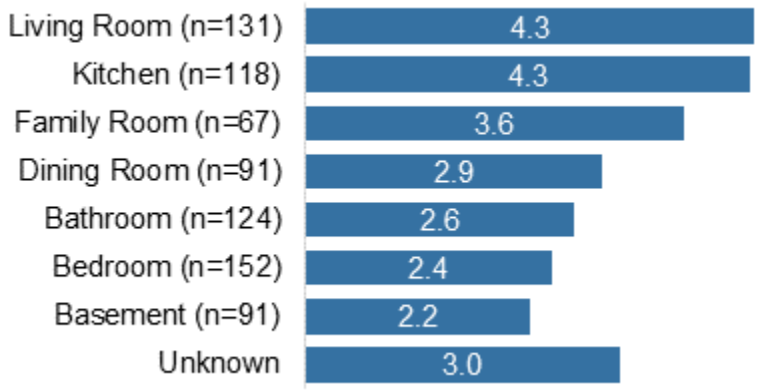


Figure 19: Hours per Day LEDs in Use by Room Type



On average, respondents took 8.3 showers per week. The average duration of each shower was 13.2 minutes. Figure 20 and Figure 21 display the distribution of shower frequency and duration among respondents.

Figure 20: Showers per Week (n=21)

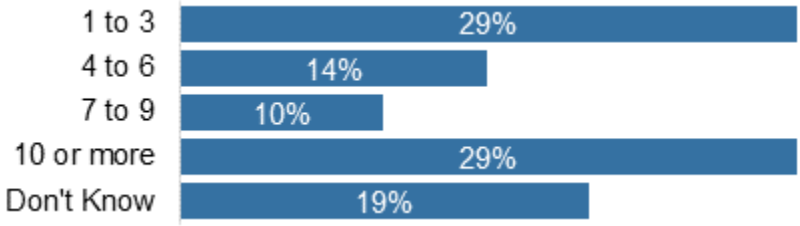


Figure 21: Minutes per Shower (n=16)

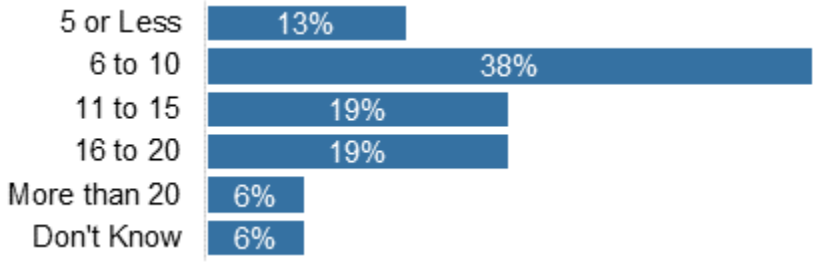


Figure 22 displays the minutes per day respondents with and without dishwashers used their kitchen aerators. Less than one-quarter (24%) of respondents provided an estimate of their daily kitchen aerator use. On average, these respondents used their aerators for 35 minutes per day.

Figure 22: Minutes per Day Kitchen Aerator in Use

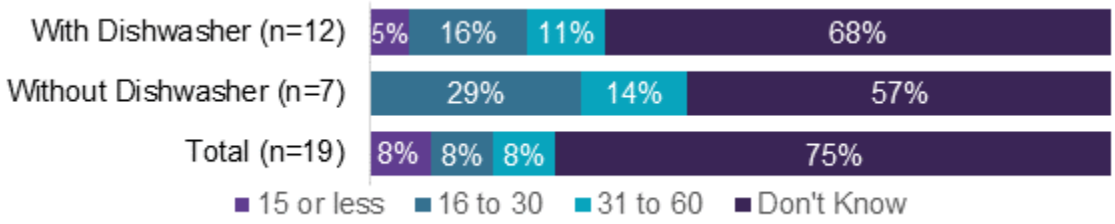
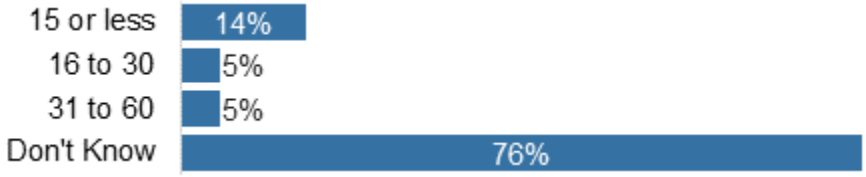


Figure 23 displays the minutes per day respondents used their bathroom aerators. On average, respondents used their aerators for 20.0 minutes per day. Readers should note that since most respondents (76%) did not know how many minutes per day their aerators were in use, this average is based on only five responses.

Figure 23: Minutes per Day Bathroom Aerator in Use (n=21)



On average, respondents used their dehumidifiers for 6.1 months of the year, 6.7 days per week, and 17.3 hours per day. Figure 24, Figure 25, and Figure 26 display the distribution of months per year, days per week, and hours per day respondents used their dehumidifiers.

Figure 24: Months per Year Dehumidifier in Use (n=33)

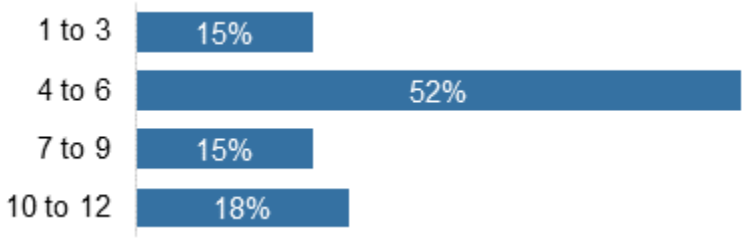


Figure 25: Days per Week Dehumidifier in Use (n=33)

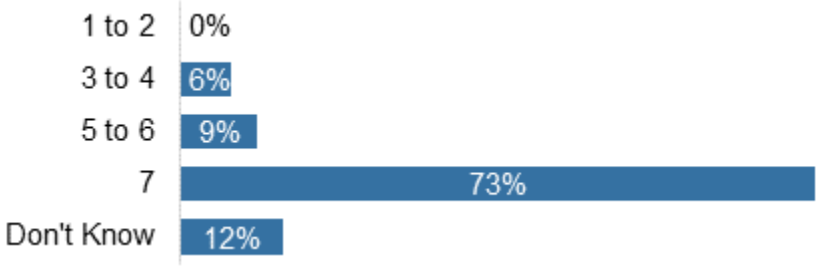
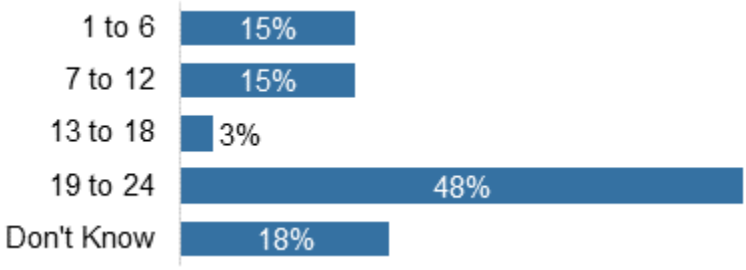


Figure 26: Hours per Day Dehumidifier in Use (n=33)*

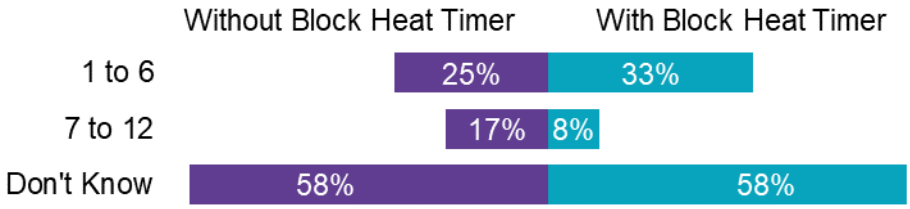


*Does not sum to 100% due to rounding.

Before receiving the block heater timers provided by the program, respondents used their block heaters for 4.9 hours per day on average. After installing the block heater timers, respondents used their block heaters for an average of 3.7 hours per day. Figure 27 displays the distribution of hours per day that respondents used their block heaters before and after receiving the block

heater timers. Readers should note that since most respondents (58%) did not know how many hours per day their block heaters were in use, these averages are based on only five responses.

Figure 27: Hours per Day Block Heater in Use (n=12)



Appendix C Additional Process Evaluation Results

This section provides additional Process evaluation results. Higher level results were provided in Section 5.

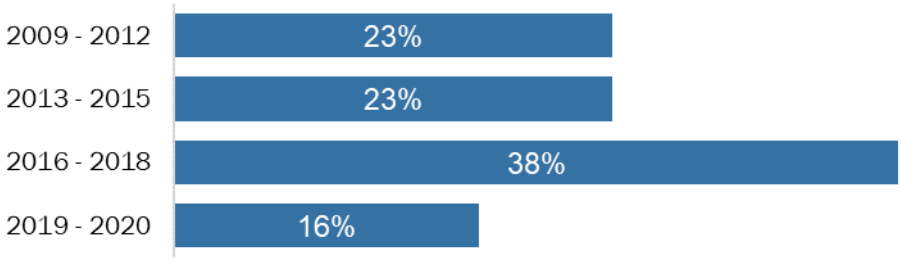
C.1 Additional Auditor and Contractor Results

This section provides additional detail regarding the process evaluation results collected as part of the auditor and contractor survey.

C.1.1 Program Experience

Figure 28 displays the year respondents began working with the either the Energy Affordability Program or the Home Assistance Program (HAP), the predecessor to EAP. Less than one-half (46%) of respondents had been working with the program since 2015 or earlier.

Figure 28: Year Began Working with EAP or HAP (n=31)*



*Does not sum to 100% due to rounding.

Figure 29 displays the number of projects respondents reported completing in PY2021 through both HAP and EAP. Most (29 of 31) worked on single-family homes, while just under one-half (14 of 31) worked on multifamily homes. Over one-half (56%) who worked on single-family homes completed between 100 and 500 single-family projects. Most who worked on multifamily homes (70%) completed less than 100 multifamily projects. On average, auditors completed 418 projects, contractors completed 1,226 projects, and respondents who served as both completed 155 projects.

Figure 29: Number of HAP and EAP Projects

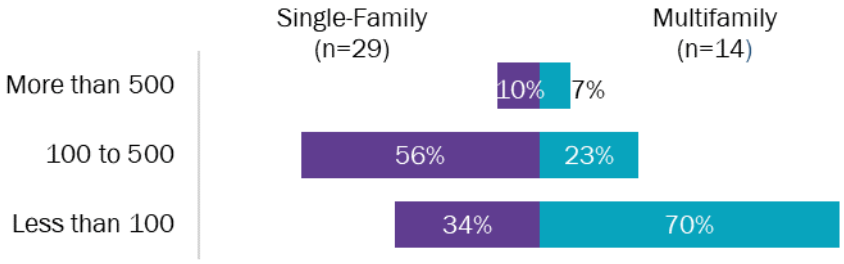
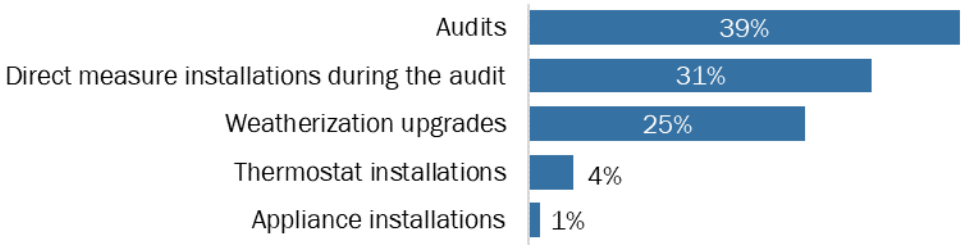


Figure 30 displays the type of work respondents performed for the program in PY2021. Most respondents (39%) conducted audits, under one-third (31%) performed direct measure installations during the audit, and one-fourth (25%) performed weatherization upgrades. Very few respondents (4%) installed thermostats. Even fewer respondents installed appliances (1%).

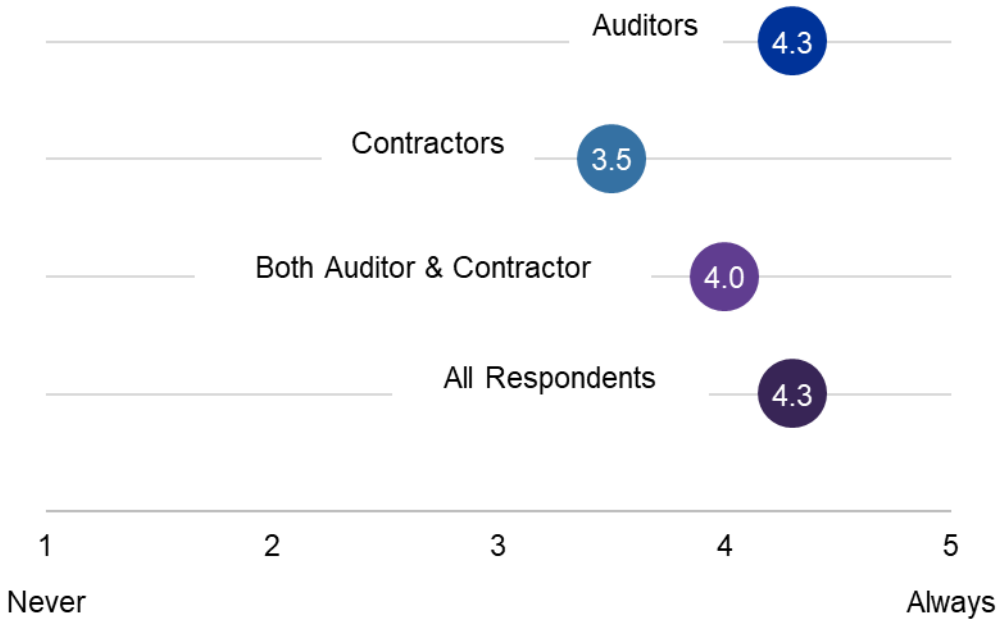
Figure 30: Type of Work Performed for EAP (n=31, Multiple Response)*



*Does not sum to 100% due to multiple response.

Using a scale from 1 to 5, where 1 meant “never” and 5 meant “always,” respondents indicated how often they inform customers about the program. Figure 31 displays the average rating among respondents by their role. The average rating among all respondents was quite high at 4.3. Auditors indicated that they inform customers about the program a little more often than contractors (4.3 compared to 3.5). Respondents who do not inform customers about the availability of the program said that they are not instructed or trained to do so, with one respondent noting that they encourage participating customers to reach out to their gas providers about qualifying programs.

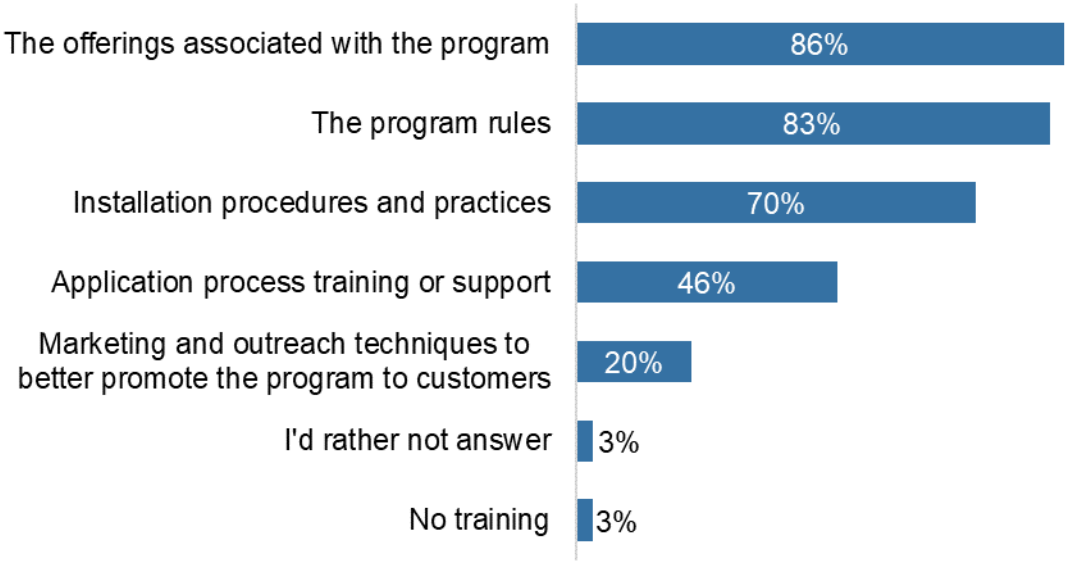
Figure 31: How Often Respondents Inform Customers about EAP (n=28)*



*Three respondents are excluded from this figure due to reporting the question was not applicable to them.

Figure 32 displays the types of training respondents received from the program delivery vendor. Most respondents received training on the offering associated with the program (86%), the program rules (83%), and installation procedures and practices (70%). Less than one-half (46%) of respondents received training on the application process and one-fifth (20%) received training on marketing and outreach techniques.

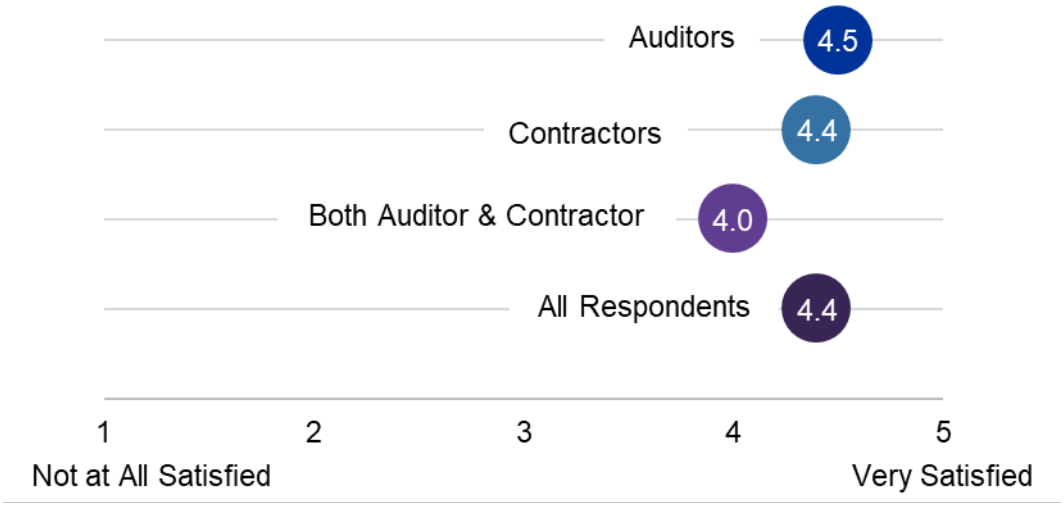
Figure 32: Type of Training from Program Delivery Vendor (n=31, Multiple Response)



*Does not sum to 100% due to multiple response.

As shown in Figure 33, respondents were very satisfied with the training they received from the program delivery vendor. On a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "very satisfied," the average satisfaction rating among all respondents was 4.4.

Figure 33: Satisfaction with Training (n=29)*



*Two respondents are excluded from this figure due to reporting they did not receive training.

Over one-fourth of respondents (26%, or 8 of the 31) suggested additional training or support HAP could provide to auditors and contractors. As shown in Table 34, the most common

recommendation (mentioned by three respondents) was to increase the funding for the program. Additionally, two respondents requested additional training and information on the program, such as overall objectives, plans, and targets. Respondents also requested increased marketing and audit training, more clarity on the rules for replacing appliances, informational materials on the industry, and better communication of the expectations.

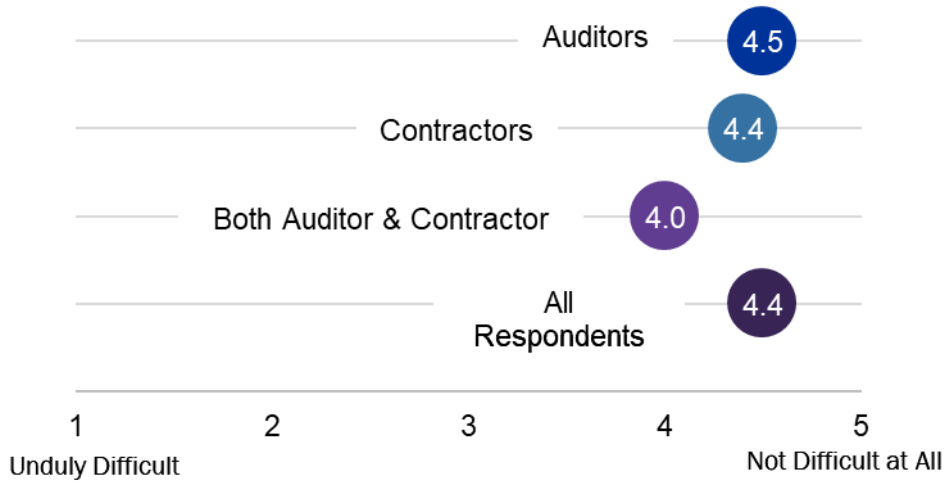
Table 34: Additional Training and Support (n=8)*

Recommendations	Respondents
Increased funding	3
Additional trainings and information	2
Increased marketing	1
Audit Training	1
Clarify rules for replacing appliances	1
Informational materials on the industry	1
Better communication of the expectations	1

*Does not sum to 8 due to multiple response.

Using a scale from 1 to 5, where 1 meant "unduly difficult" and 5 meant "not difficult at all," respondents indicated how difficult it was to perform the blower door test at customer sites. As shown in Figure 35, the average rating among all respondents was 4.4, indicating that it was not difficult. Additionally, only 6% of respondents thought that the blower door test discouraged auditors or contractors from working with EAP. One respondent noted that "blower doors are not necessary for every home" and two respondents believed the blower door test discourages more auditors or contractors from working with the program.

Figure 35: Difficulty of Performing Blower Door Test (n=19)*

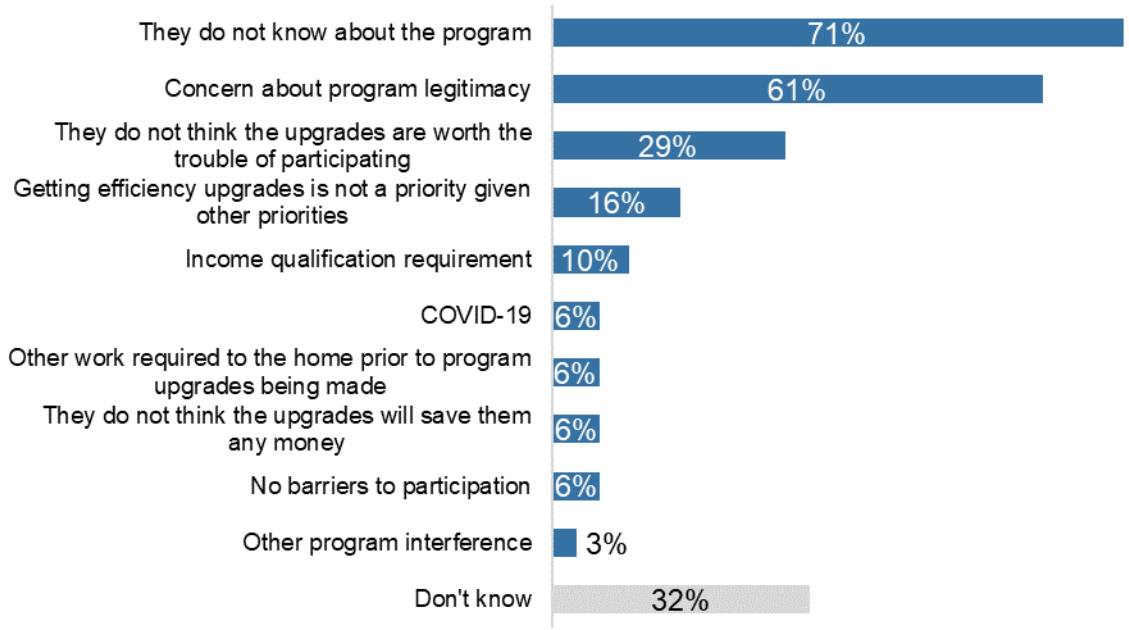


*Two respondents are excluded from this figure due to reporting they did not know how difficult the test was to perform. Ten respondents noted that they do not perform blower door tests.

C.1.2 Program Barriers

Figure 36 displays the barriers respondents thought prevented households from participating in EAP. The most commonly identified barriers were low program awareness among customers (71%). Section 5.2.3 includes more discussion around barriers.

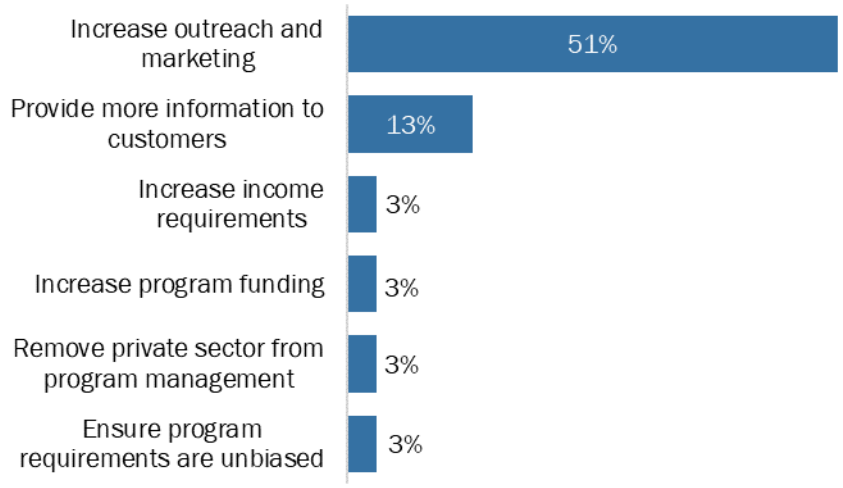
Figure 36: Barriers to EAP Participation (n=31, Multiple Response)*



*Does not sum to 100% due to multiple response.

Figure 37 displays respondents' recommendations for overcoming barriers to EAP participation, the most common of which was to increase marketing (suggested by 51% of respondents). Section 5.2.3 includes more discussion around recommendations to address barriers.

Figure 37: Recommendations for Overcoming Barriers to Program Participation (n=31, Multiple Response)*



*Does not sum to 100% due to multiple response.

C.1.3 Measure Eligibility Criteria

Table 21 displays respondent perspectives on how the program's measure eligibility criteria affected the frequency with which program measures were installed. Section 5.2.4 includes more discussion around measures affected by the eligibility criteria.

Table 21: Measures Affected by Measure Eligibility Criteria (n=11; Multiple Response)

Measures	Increased Installation Frequency (n=3)	Decreased Installation Frequency (n=8)
Air conditioners	-	1
Aerators and showerheads	-	1
Appliances	2	3
Insulation	-	3
Lighting	-	2
All measures	1	-

*Does not sum to 11 due to multiple response.

As shown in Table 22, Over two-fifths of respondents (13 out of 31) suggested adjustments to measure eligibility criteria for the Energy Affordability Program to consider in future years with the most commonly suggested request being to relax the requirement for cooling equipment (three respondents) by allowing equipment with lower EER ratings to qualify. Section 5.2.4 includes more discussion around recommended measures eligibility criteria adjustments.

Table 22: Recommended Adjustments to Measure Eligibility Criteria (n=13; Multiple Response)*

Recommendations	Respondents
Relax requirement for cooling equipment	3
Review appliance age requirements	1
Add more appliance types and models	1
Allow more fuel sources (e.g., oil, propane, wood)	1
Include thermal barriers for spray foam insulation	1
Offer a wider variety of smart power fridges and freezers	1
Proper sized appliances	1
Remove metering requirements for fridges and freezers	1
Remove showerhead offering	1
Consider heat pumps	1
Consider induction stoves	1
Stricter eligibility in general	1

*Does not sum to 13 due to multiple response.

C.1.4 Measure-Related Cost Caps

Table 23 displays respondents' recommendations for changes to the measure-related cost caps in case cost increases due to the COVID-19 pandemic continue. Most of the respondents providing feedback recommended adjustments to the cost caps for insulation. Section 5.2.5 includes more discussion around recommendations for measure-related cost caps.

Table 23: Recommendations for Measure-Related Cost Caps (n=10; Multiple Response)*

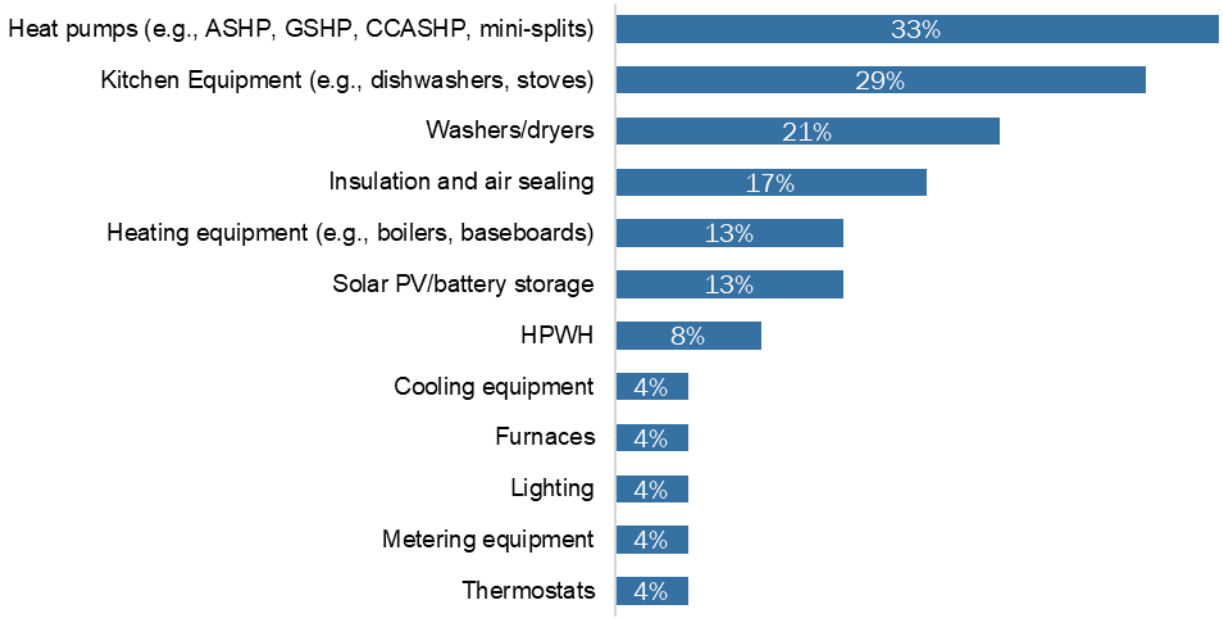
Recommendations	Respondents
Adjust insulation cost caps to account for increased costs	7
Take into account fuel travel costs	3
Appliance cost cap review	1
Increase cost caps in general	1
Lower cost caps generally	1
Review air sealing cost caps to ensure they cover blower door tests and thermal cameras	1
Review cost caps every six months	1

*Does not sum to 10 due to multiple response.

C.1.5 Recommendations for Program Improvement

Figure 38 displays respondents' recommendations for energy-efficient equipment or services that they would like to see included in the program. The most frequently recommended equipment type was heat pumps (33%). Section 5.3.5 includes more discussion around recommendations for equipment and services.

Figure 38: Recommendations for Additional Equipment or Services (n=24, Multiple Response)*



*Does not sum to 100% due to multiple response.

Table 24 displays respondents' recommendations for improving the program, with over one-half (55%) providing recommendations. Outreach and marketing was recommendation most frequently (6 respondents). Section 5.2.6 includes more discussion around recommendations for the program.

Table 24: Recommendations for Improving Program (n=17, Multiple Response)*

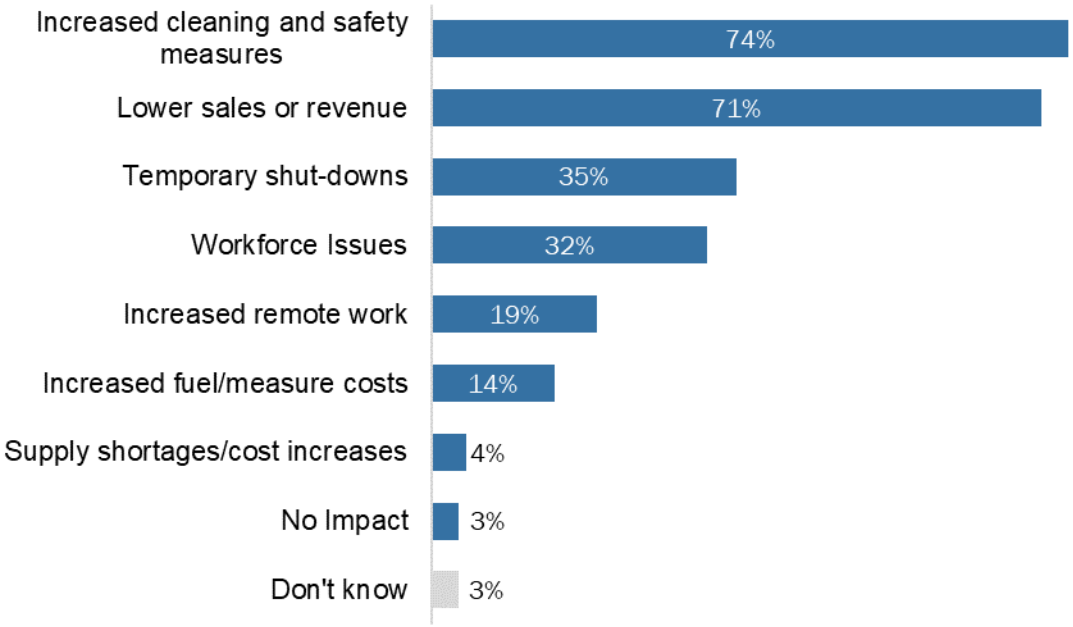
Recommendations	Respondents
Outreach and marketing	6
Increase funding for auditors and contractors	2
Avoid switching service providers	2
Better training	1
Improve program software	1
Include more qualification questions in the screening process	1
Remove blower door service	1
Change metrics for energy saving	1
Cap the number of audits per day	1
Better prepare clients for site visits	1

*Does not sum to 17 due to multiple response.

C.1.6 COVID-19 Impacts

Figure 39 displays the impacts the COVID-19 pandemic had on auditors' and contractors' businesses. Around three-fourths (74%) of respondents increased their cleaning and safety measures, while over two-thirds of respondents (71%) experienced a slowdown in demand causing lower sales and revenue. Over one-third of respondents each experienced temporary shutdowns (35%) or workforce issues (32%). Nearly one-fifth (19%) of respondents experienced an increase in remote work, while less than one-sixth (14%) of respondents dealt with an increase in fuel and/or measure costs.

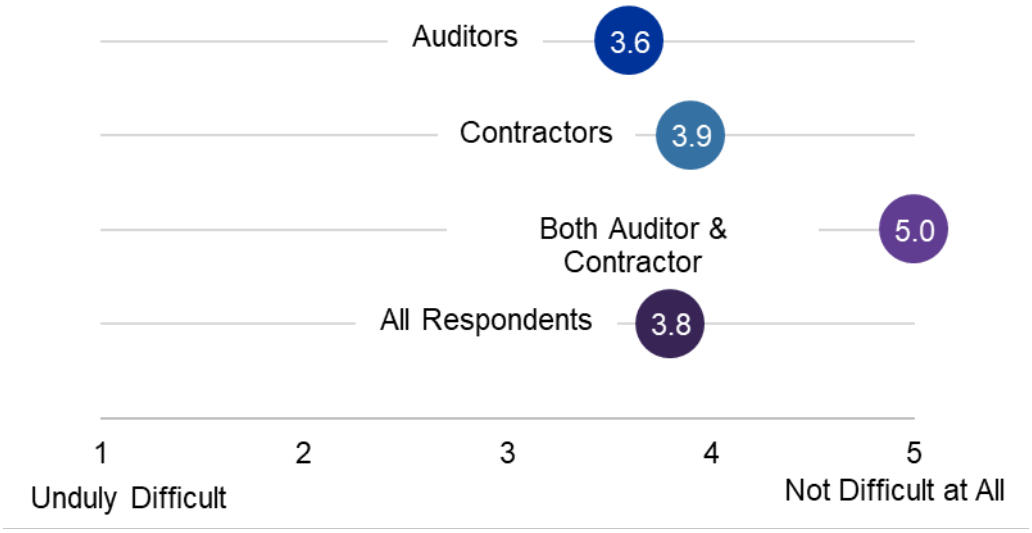
Figure 39: Impacts of COVID-19 on Business (n=31, Multiple Response)*



*Does not sum to 100% due to multiple response.

Using a scale from 1 to 5, where 1 meant "unduly difficult" and 5 meant "not difficult at all," respondents indicated how difficult it was to adhere to health and safety standards relevant to the COVID-19 pandemic. As shown in Figure 40, the average rating among all respondents was 3.8, indicating that it was not very difficult. Nine respondents suggested ways to make it easier for them to comply with relevant health and safety standards, with three suggesting enforcements of local requirements, two suggesting dropping all health and safety standards associated with COVID-19 crisis, one suggesting keeping the mask requirement, and one suggesting additional trainings and rewards for following protocols.

Figure 40: Difficulty of Adhering to Health and Safety Standards (n=31)



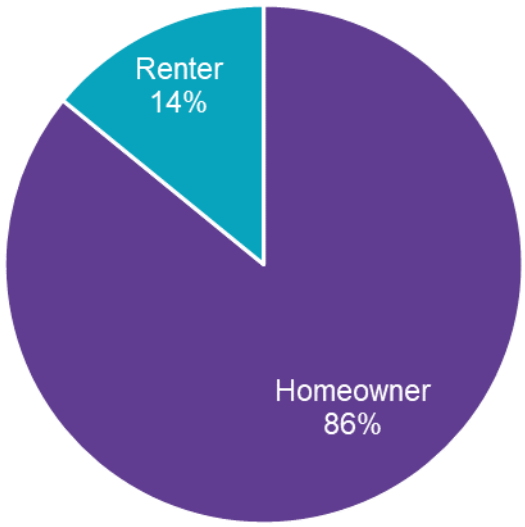
C.2 Additional Participant Results

This section provides additional detail regarding the process evaluation results collected as part of the auditor and contractor survey.

C.2.1 Participant Profile

As shown in Figure 41, most respondents (86%) are homeowners, while 14% are renters.

Figure 41: Relationship to Home (n=319)



Respondents' homes are predominantly primary residences (97%) that are occupied year-round (94%). Figure 42 and Figure 43 display characteristics of respondents' homes, including the type of dwelling and the year it was built. Over two-thirds (69%) of respondents' homes are single-family houses. Most respondents' homes (79%) were built prior to 1990.

Figure 42: Type of Home (n=319)

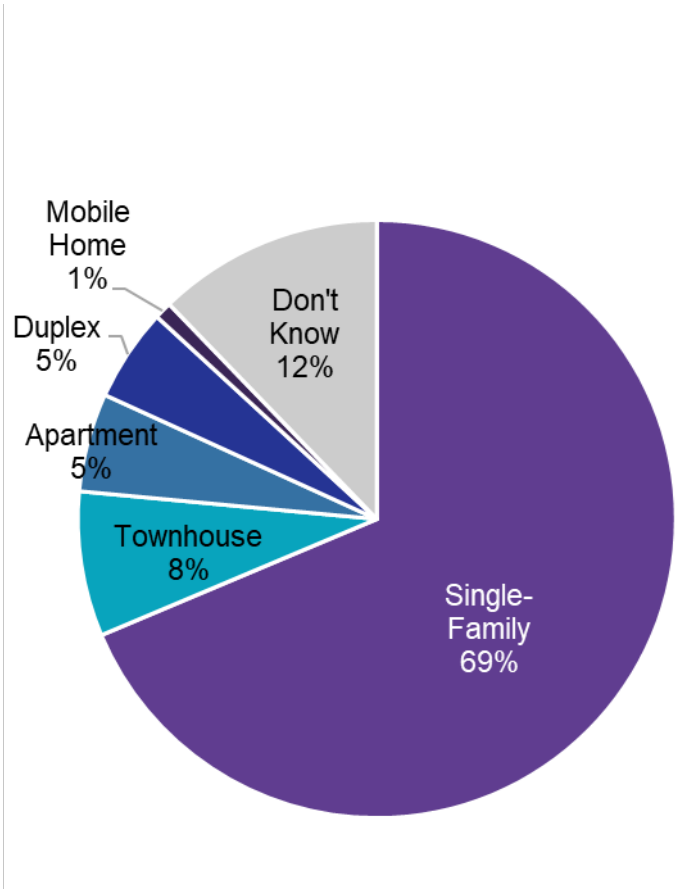
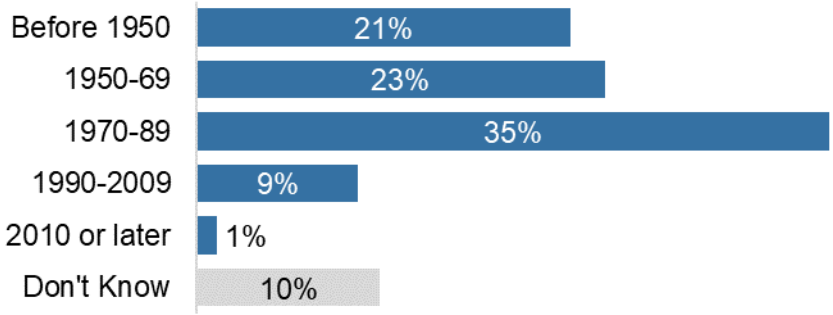


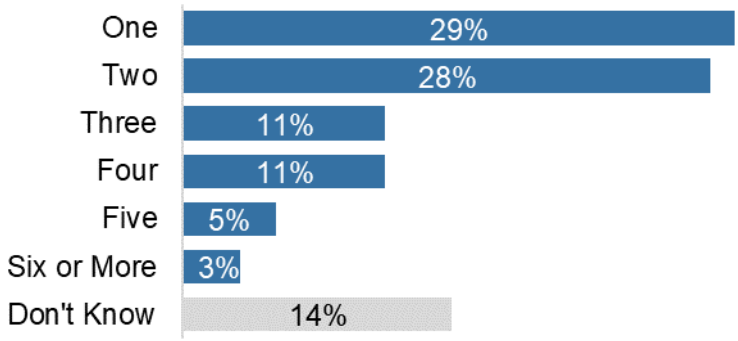
Figure 43: Year Home Built (n=319)*



*Does not sum to 100% due to rounding.

Figure 44 displays the number of occupants in the respondents' households. Almost one-third (29%) of respondents live alone. The average household size among respondents was 2.4.

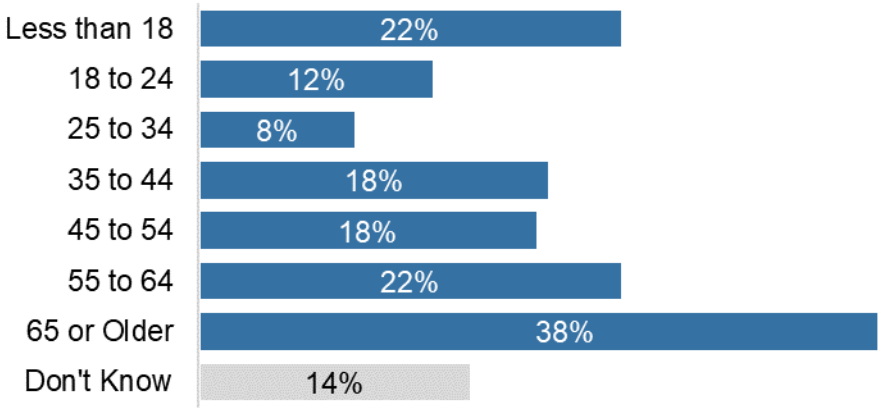
Figure 44: Number of Occupants (n=319)*



*Does not sum to 100% due to rounding.

Figure 45 displays the percent of households with occupants of each age group. Children under the age of 18 reside in more than one-fifth (22%) of households and seniors aged 65 or older reside in approximately two-fifths of households (38%).

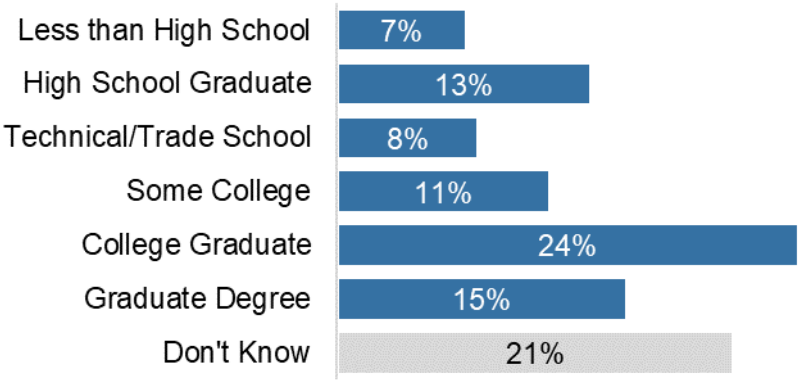
Figure 45: Households with Occupants of Each Age Group (n=319)*



*Does not sum to 100% due to multiple response.

Figure 46 displays respondents' highest education level. Two-fifths (39%) of respondents have a college degree or higher.

Figure 46: Highest Education Level (n=319)*

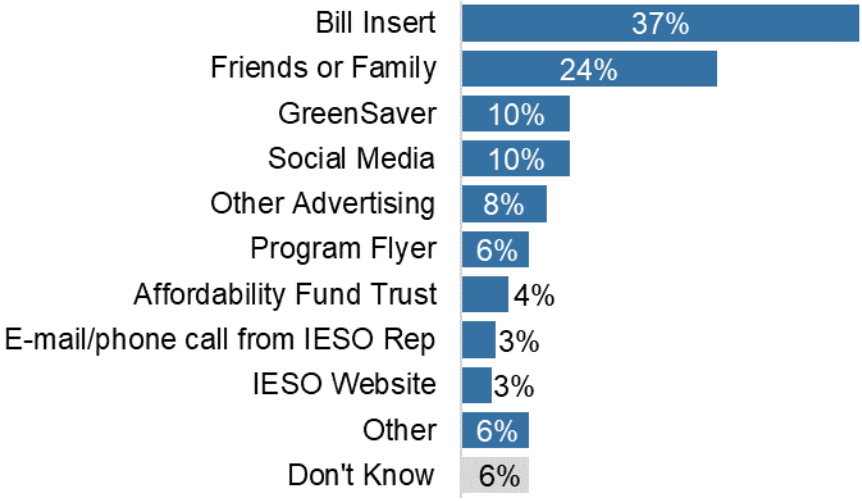


*Does not sum to 100% due to rounding.

C.2.2 Program Awareness and Motivation

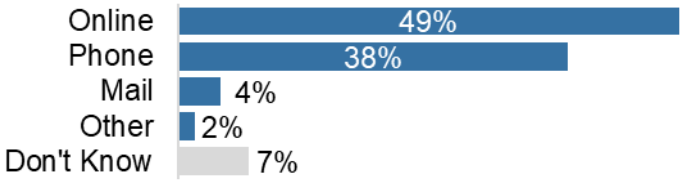
Figure 47 and Figure 48 show how respondents heard about and applied to the program. Section 5.3.2 includes more discussion around how participants heard about and applied to the program.

Figure 47: How Participants Heard about HAP (n=319; Multiple Response)*



*Does not sum to 100% due to multiple response.

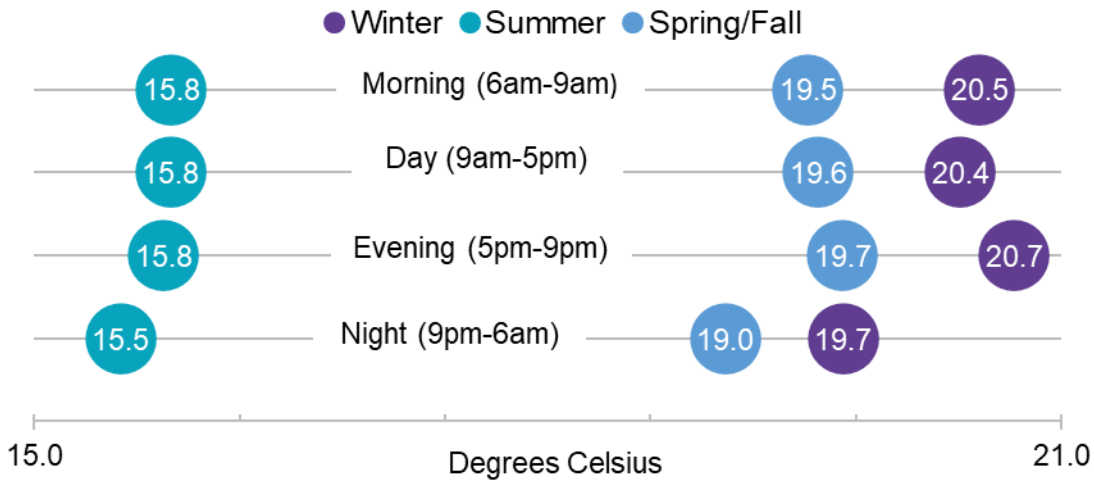
Figure 48: How Participants Applied for HAP (n=319)



C.2.3 Program Education and Behavior Change

Figure 49 displays the average temperature (in degrees Celsius) that respondents set their thermostats to during various times of the day and year. Not surprisingly, respondents set their thermostats lowest during the summer and highest during the winter. Respondents set their thermostats highest during the evening (5:00 p.m. to 9:00 p.m.) and lowest at night (9:00 p.m. to 6:00 a.m.).

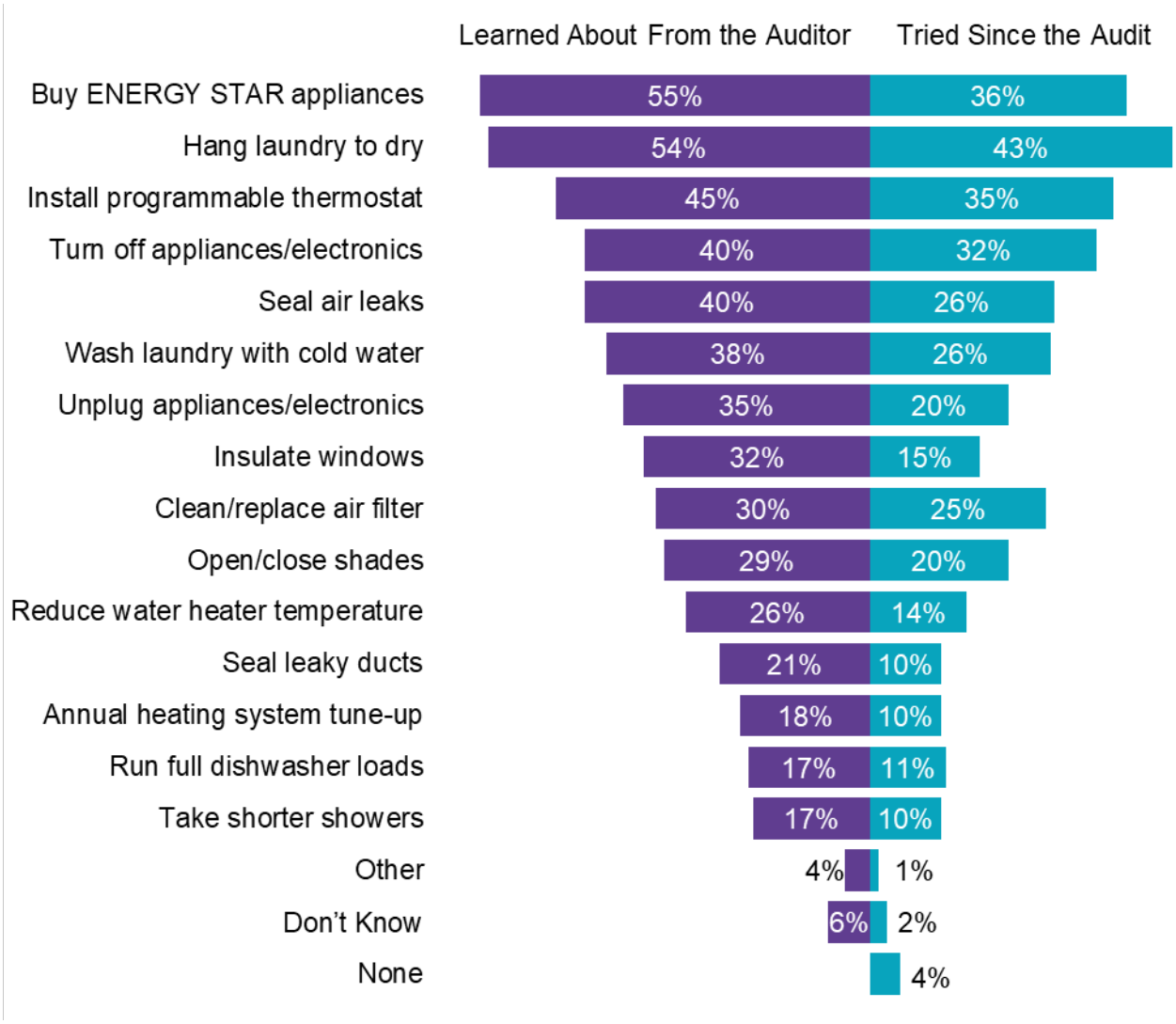
Figure 49: Participant Thermostat Settings (n=282)



Around one-half (48%) of respondents said that at the time of the energy audit, the auditing staff provided them appropriate thermostat ranges for different seasons. Over one-half (58%) of respondents said the contractor programmed the temperature settings rather than the respondent.

Figure 50 displays the additional energy-saving methods respondents said their auditor suggested. Section 5.3.3 includes more discussion around the additional ways to save energy that were recommended and tried.

Figure 50: Additional Ways to Save Energy (n=168)*

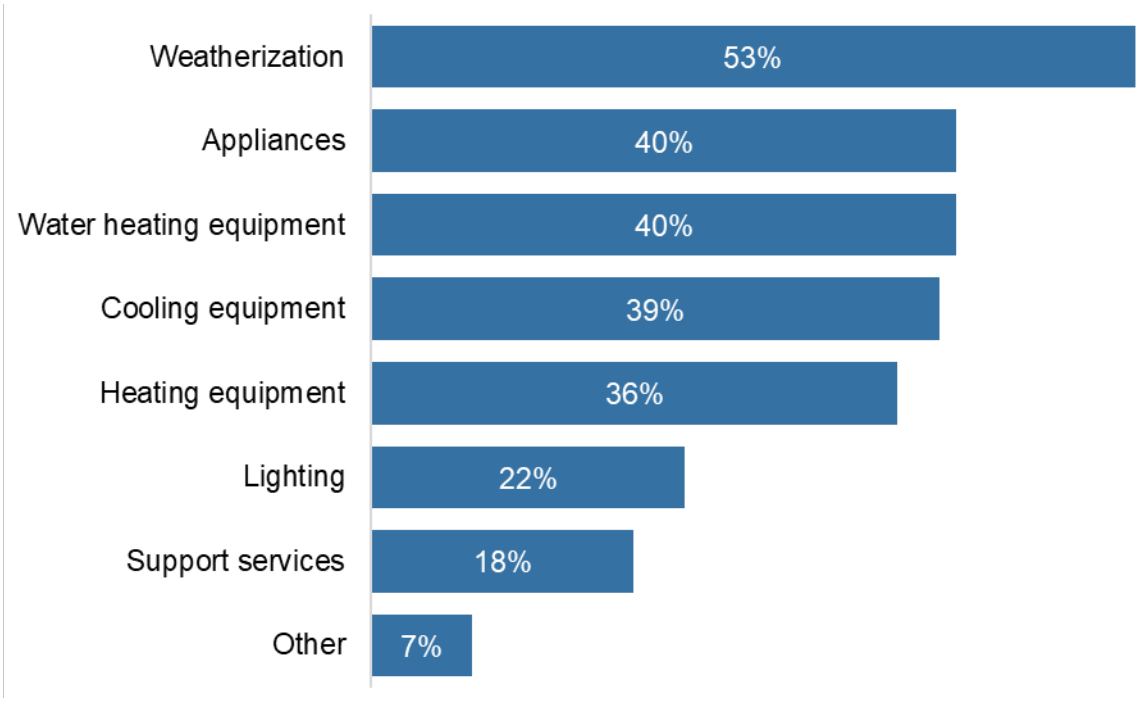


*Does not sum to 100% due to multiple response.

C.2.4 Recommendations for Program Improvements

Figure 51 provides a list of recommendations offered by close to one-half (171 out of 319) of responding participants for additional energy-efficiency equipment or services for inclusion in the program. Section 5.3.5 includes more discussion around these suggestions.

Figure 51: Additional Equipment or Services (n=171; Multiple Response)*



*Does not sum to 100% due to multiple response.

C.2.5 COVID-19 Impacts

Respondents rated the program energy auditors and contractors highly in terms of how they adhered to the relevant health and safety standards associated with the COVID-19 pandemic. Most respondents (87%) assigned a rating of 4 or 5 on a scale from 1 to 5, where 1 meant "did not adhere at all" and 5 meant "adhered completely" (Table 25). The average rating was 4.7.

Table 25: Adherence to Health and Safety Standards Associated with Covid-19 Pandemic (n=319)

Adherence to Health and Safety Standards	Percent of Respondents
5- Adhered completely	77%
4	10%
3	3%
2	2%
1- Did not adhere at all	1%
Don't know/Refused	7%
Average Rating	**4.7**

Appendix D Additional Jobs Impact Analysis

This appendix presents additional results associated with the jobs impact analysis. Higher-level results were provided in Section 6.

Input-Output models are informative for understanding the potential magnitudes and dynamics of economic shocks created by policies and programs. While useful, the StatCan IO Model is a simplified representation of the Canadian economy and thus has limitations. The model is based on the assumption of fixed technological coefficients. It does not take into account economies of scale, constraint capacities, technological change, externalities, or price changes. This makes analyses less accurate for long term and large impacts, where firms would adjust their production technology and the IO technological coefficients would become outdated. Assuming that firms adjust their production technology over time to become more efficient implies that the impact of a change in final demand will tend to be overestimated. For household consumption, the model is based on the assumptions of constant consumption behavior and fixed expenditure shares relative to incomes.

D.1 Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from HAP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 26 shows the input values for the demand shock representing the products and services related to HAP. Each measure installed as part of HAP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

The first six rows of the table contain the categories corresponding to products, which were the measures installed in homes. The last two rows contain the services. Of the six product measures, Electric light bulbs and tubes had the highest total cost at just over $1.4 million and Major appliances was second highest at just under $1.4 million. Each measure's cost was divided into labor and non-labor. Electric light bulbs and tubes and Other miscellaneous manufactured products did not have any assumed labor costs for measure installation. The Non-metallic mineral products category was mainly insulation, for which labor represented 70 percent of the total cost. Small electric appliances included thermostats, which had installation costs around 50% of the total. The installation cost for the Major appliances category was roughly 11%.

For the two service categories in Table 26, Office administrative services included general overhead and administrative services associated with program delivery, such as program management and staffing, call center operations, and IESO admin labor. The Other professional, scientific and technical services included the audits. The total demand shock represents the sum of the audit fees. The labor and non-labor amounts are not specified for these services, as the IO Model has assumptions incorporated for the relative proportions of each for these categories.

Table 26: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Electric light bulbs and tubes	302	0	302
Major appliances	2,300	292	2,592
Non-metallic mineral products, n.e.c.	209	486	695
Other miscellaneous manufactured products	60	0	60
Small electric appliances	100	100	199
Switchgear, switchboards, relays and industrial control apparatus	326	223	548
Other professional, scientific and technical services	-	-	279
Office administrative services	-	-	988
Total			**5,663**

Table 27 shows the calculations and input value for the household expenditure shock.[33] This shock represents the net additional amount that households would inject back into the economy through spending. The model does not distinguish between participants and non-participants in the residential sector, so the net amount of additional money households (as a whole) would have available is the difference between the bill savings (Net Present Value (NPV) = $6.1 million) and the portion of all energy-efficiency programs funded by the residential sector (35%, or $2.0 million). The difference is $4.1 million and represents the additional money that households could either spend on goods and services or save, pay off debt, or otherwise not inject back into the economy. The surveys administered to participants as part of the HAP process evaluation included several questions about what households would do with the money that they saved on their electricity bills. From the survey responses, we estimated that 36% of household bill savings would be spent. Thus, the household expenditure shock would be $1.5 million.

[33] The model is actually run with a normalized value of $1 million in extra household expenditures and the job results can be scaled by the actual demand shock.

Table 27: Summary of Input Values for Household Expenditure Shock

Description	Total Shock ($ Thousands)
NPV of energy bill savings	6,111
Residential portion of program funding	(1,982)
Net bill savings to residential sector	**4,128**
Percent spent on consumption (vs. saved)	36%
Total Shock	**1,484**

D.2 Model Results

The StatCan IO Model generated results based on the input values detailed in Table 26. Table 28 shows the results of the model run for the demand shock for products and services. This shock represented the majority of the job impacts. As the two right columns show, the model estimated that the demand shock will result in the creation of 46 total jobs (measured in person-years) in Canada, of which 42 will be in Ontario. Of the 46 jobs, 22 were direct, 12 were indirect, and 12 were induced. In terms of FTEs, the numbers are slightly less, with 34 FTEs created in Ontario and 37 in total across the country. Of these 37 FTEs, 19 were direct, 9 indirect, and 9 induced. As the table shows, the direct job impacts were realized exclusively in Ontario. As we move to indirect and induced jobs, impacts are dispersed outside of the province.

Table 28: Job Impacts from Demand Shocks

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* *Total*	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	19	19	22	22
Indirect	8	9	11	12
Induced	7	9	9	12
Total	**34**	**37**	**42**	**46**

Table 29 shows the results of the model run for the household expenditure shock. This shock is actually run off a normalized $1 million bundle of extra household spending, which can then be scaled by the actual household expenditure shock. The extra household spending of $1.5 million would yield 4 direct FTEs and 6 direct total jobs in Canada. Total impacts equaled 9 FTEs and 12 total jobs across Canada.

Table 29: Job Impacts from Household Expenditure Shocks

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* *Total*	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	4	4	6	6
Indirect	1	3	3	3
Induced	1	1	1	3
Total	**7**	**9**	**10**	**12**

The other factors included in the research questions were the impact of program funding on the non-residential sector and the impact from reduced electricity consumption. Assuming that businesses absorb the increases in electricity costs to fund the program, there would be no impact on jobs. There would be an impact on direct GDP (value-added), equivalent to the profit loss resulting from the increase in electricity bills from program funding. The StatCan IO Model has production functions that cannot be adjusted, so electricity price changes would be modeled by making the assumption that surplus would be reduced by the extra amount spent on electricity.

The economic impact of the reduction of electricity production as a result of the increase in energy efficiency must be examined closely. Technically speaking, it can be estimated using StatCan Input-Output multipliers[34] without running the model. The multiplier is 4.9[35] (per $ million) and the NPV of decreased electricity bills (retail) was $6.1 million. Thus, the model would predict that the reduction in electricity production would cause a job loss of 29.9 person-years over the course of 20 years (the longest EUL in the portfolio of HAP measures). However, the IO model is linear, and not well suited to model small decreases in electricity production. Total electricity demand has been increasing over time and is projected to continue increasing.[36] HAP first year energy savings represented less than 0.01% of total demand in 2021. This relatively small decrease in overall consumption may work to slow the rate of consumption growth over time but would likely not result in actual job losses in the utility industry or upstream suppliers. The linearity of the IO model means that it will provide estimates regardless of the size of the impact. Given the nature of electricity production, it is reasonable to conclude that the linear IO multiplier is not appropriate for estimating job impacts. This analysis assumes that job losses from decreased electricity production are negligible.

Table 30 shows the total estimated job impacts by type – combining Table 28 and Table 29. The majority (52 out of the 58 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 14 out of 15 indirect and 10 out of 15 induced total jobs within the province. The FTE estimates are slightly less, with a total of 41 FTEs (of all types) created in Ontario and 46 FTEs added

[34] Table 36-10-0595-01. The relevant industry is Electric power generation, transmission and distribution [BS221100].
[35] Statistics Canada. Table 36-10-0595-01 Input-output multipliers, provincial and territorial, detail level
DOI: https://doi.org/10.25318/3610059501-eng
[36] Annual Planning Outlook – A view of Ontario's electricity system needs; 2021. IESO.

throughout Canada. All direct FTEs were realized in Ontario, with this number representing 56% of the total FTEs added in Ontario and 50% of FTEs added in Canada.

Table 30: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* *Total*	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total	Total Jobs per $1M Investment *(in person-years)*
Direct	23	23	28	28	4.9
Indirect	9	12	14	15	2.6
Induced	4	10	10	15	2.6
Total	**41**	**46**	**52**	**58**	**10.2**

Calculating relative performance as a function of jobs created per $1M of program budget is helpful in comparing HAP between years. This year, each $1M investment resulted in the creation of 10.2 jobs, compared to 10.0 jobs created in 2020. Programs can increase in effectiveness—in terms of jobs created per $1M of budget—when the incentives catalyze spending by participants on energy-efficiency measures. Given that the HAP incentives cover 100% of measure costs, the relative proportion of participant spending is removed as a driver of variability, and as such the number of jobs per $1M investment is expected to remain relatively consistent from year to year.

Table 31 shows the job impacts in more detail, with jobs added by type and by industry category. Industries are sorted from top to bottom by those with most impacts to least, with industries that showed no impacts not included in the table. The table shows that the industry with the largest impacts was *Administrative and support, waste management and remediation services*, which added 24 jobs in Canada, all of which were in Ontario. This category is large and non-specific, and reflects the need to hire individuals to fill a large range of roles based on program need (e.g., office administration, call center operations, program management, etc.). *Retail trade* added a total of 9 jobs, the second most of any industry – nine of the 12 realized jobs were created in Ontario.

Table 31: Job Impacts by Industry

Output Industry Categories	FTE *(in person-years)* - Ontario	FTE *(in person-years)* - Total	Total Jobs *(in person-years)* - Ontario	Total Jobs *(in person-years)* - Total
Administrative and support, waste management and remediation services	20	20	24	24
Retail trade	6	6	8	9
Accommodation and food services	2	2	3	3
Finance, insurance, real estate, rental and leasing and holding companies	2	3	3	3
Wholesale trade	2	3	2	3
Manufacturing	2	2	2	2
Professional, scientific and technical services	1	2	2	2
Transportation and warehousing	1	2	1	2
Other services (except public administration)	1	1	1	2
Health care and social assistance	1	1	1	1
Arts, entertainment and recreation	0	0	1	1
Information and cultural industries	1	1	1	1
Repair construction	1	1	1	1
Government education services	0	0	0	1
Total[1]	**41**	**45**	**52**	**57**

[1] Columns may not add to totals due to rounding. Real values are rounded to nearest whole number and the whole numbers do not sum exactly to the whole number total in every column.